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ABSTRACT

The three papers compiled here on vocational and technical education in Europe were prepared and discussed by experts in the course of three meetings held in 1977. Focus is on polyvalent occupational training, which prepares students for maximum adaptability to technical and social changes and for occupational mobility. The first paper describes ways in which polyvalent training can be achieved and defines basic occupational training in terms of considerations external to and within the training system. The second paper deals with systematic analysis applied to the conception of a basic occupational training course and includes skills and educational objectives; structural analysis of three levels of a system (learning, production, and social); and relationships among social behaviors, production activities, and educational contents. The next paper covers the role of work systems analysis in the determination of occupational skills to be developed in education and training. The last paper discusses the concept of occupational families in relation to occupational training, including aims, implications, methods, and contents. (EM)

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TECHNICAL AND VOCATIONAL EDUCATION

OCCUPATIONAL BASIC TRAINING

1

Preliminary Definition of a Polyvalent and Cultural Occupational Basic Training

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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COMMITTEE FOR GENERAL AND TECHNICAL EDUCATION

OCCUPATIONAL BASIC TRAINING

1

Preliminary definition of a polyvalent and cultural occupational basic training

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The following papers were prepared and discussed by a group of experts of the Council of Europe in the course of three meetings held in Strasbourg in 1977.

Two further publications are being produced:

2. Examples of the application of a methodology: United Kingdom and Italy.

3. Monograph on the construction of a system.

The members of the group were the following:

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I. BASIC TRAINING AND POLYVALENT TRAINING

Y Deforge

The first discovery we make, when trying to discuss technical and vocational training in terms relevant to the whole of Europe, is that the semantic fields of a number of apparently identical expressions do not coincide in the different countries.

The Council of Europe and other national and international bodies have attempted to establish equivalences in specialised glossaries (1). It would be futile, however, to seek by means of rigid definitions to establish unvarying meanings for such terms as "occupational basic training" or "vocational polyvalence", for they pertain to very fluid fields which are constantly being subjected to pressure from research, innovation and even polemics.

Nevertheless, after listening to and reading European experts on technical and vocational training one begins to sense that a common conceptual substratum may exist, implicitly, beneath the various interpretations and connotations. But although this vagueness in communication may be found acceptable and even useful in some circumstances, it is much less so when the object is that of the authors of this study, which is to reach beyond the juxtaposition of viewpoints in order to produce consistent and explicit indicators of what is to be understood by "occupational basic training".

A comparative study of semantic fields can be of value, as in the case of polyvalence (2), but terms such as "basic training" and "polyvalence" need to be approached through analysis of objectives. As will be seen below, explicit objectives are often very rudimentary - perhaps because too little careful thought has been given them, or because the true objectives can only be glimpsed beneath the surface.

The approaches adopted in defining the contents of a so-called "basic" or "polyvalent" training, on the other hand, are relatively easy to identify, and through those approaches, it is possible to discern the intentions, value judgements and options relating to both present and future - some of the major objectives, in other words - whether they are explicitly stated or not.

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(1) "Glossary of terms used in technical and vocational education", Council of Europe, Strasbourg, CCC/EGT (77) 23, 1977

(2) Gentz (H): La polyvalence dans la formation professionnelle, EEC Commission, Brussels, 1970.

1. Occupational basic training

Although "occupational basic training" may not be specified in every instance, that is what is meant; I mention this in order to make it clear that basic training, as a unit corresponding to the intermediate instruction which precedes the end of compulsory schooling, has been excluded.

In some countries, however, between the end of compulsory schooling and vocational instruction, or between primary and vocational education, there is a form of prevocational or introductory technical and vocational training, or preparation for work (United Kingdom, Netherlands, France and the Arbeitslehre in the Federal Republic of Germany), sometimes described as "basic".

As a rule (Federal Republic of Germany, Denmark, Ireland, United Kingdom, Netherlands), the unit comprising the first or first and second years of vocational training is called "basic", "fundamental" or "common core".

In some systems the term "basic module" is occasionally employed to designate a nucleus offered to anyone beginning a vocational education at any time. In Italy, for example, the modular system of the ISFOL (1) for the occupational basic training of adults and young people out of school contains four modules. The first, or "base of base", renews and fortifies former learning, familiarises pupils with products and processes, and gives an introduction to the social context.

At first sight, we note that a "base" is a very broad, quasi-topological concept: it is a seat for what comes after it and is seated upon what has gone before. Thus expressed, the concept is no more than truism, but in many instances it is supplemented by an idea of continuity, of degressive imbrication, a basic general (non-vocational) education being followed by a "broad base vocational training", then by specialisation and in-depth training. This produces the multi-storey structure, so conventional that it has become the stereotype representative of a large number of training systems (2); yet it tells us nothing explicit about the contours of the first storey (period, year, variable module) or what it contains. At this point, a distinction should be made, or a similarity established, between basic and polyvalent training.

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(1) ISFOL: Innovazioni didattiche nella formazione professionale di base, Rome, 1977.

(2) Deforge (Y): Interim report, Council of Europe, Strasbourg, CCC/EGT (76) 27, 1977.

2. Polyvalent training (*)

The Council of Europe study on polyvalent vocational training (1) gives the following definition of its objectives: "/it aims/ to give students and apprentices a broad basic education and training in such theoretical and practical knowledge as they will need especially in the sectors in which they will work during their occupational career, taking into account the special features of their work environment, and so will give them the maximum adaptability to technical and social change in their work (refresher training) as well as preparation for occupational mobility, both vertically (by promotion) and horizontally (by resettlement)".

Occupational polyvalence was initially regarded as a necessary attribute of the worker in an expanding and changing industrial and economic world. When the recession came, that same polyvalence was suddenly seen as a weapon, a defence against unemployment and laying-off. In both cases it was associated with the idea of mobility, and this was given the value of a cultural dimension.

Elsewhere, I have shown the origin of these postulates and their ambiguity or even fallacy (2).

Occupational polyvalence corresponds to polyvalent occupational training. In several countries (France, Netherlands, and Luxembourg to some extent), polyvalent training is associated with a theory of training which refers to the entire process, and for them is opposed to highly specialised vocational training; but in others, it is a basic training which precedes further training in one or more specialisations.

From this point of view, thus, there is a close relationship between polyvalent training and basic training.

The analysis of training systems which claim to produce polyvalence reveals four different ways of achieving this end:

- by juxtaposing a series of distinct training processes;
- by acquiring more and deeper technical knowledge in one field of specialisation;
- by raising the level of general knowledge;
- by emphasising the features shared by several training processes - these may be knowledge, aptitudes or attitudes.

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(1) Polyvalent vocational training, Council of Europe, Strasbourg, 1971.

(2) Deforge (Y): Differences of interpretation and conceptual ambiguity: mobility, Council of Europe, Strasbourg, DECS/EGT (75) 36, 1975.

(*) In Belgian texts the term "omnivalence" is sometimes found and pluri-professionnel also occurs from time to time.

2.1 Polyvalence and basic training through juxtaposition

Sometimes the term "polyvalent" is applied to occupational activities involving an alternation of dissimilar situations: in this sense a polyvalent worker is one who is capable of occupying several work posts.

There is a danger that because of this plurality of occupational situations, polyvalent training may be seen simply as a succession of apprenticeships for a number of trades.

And so it is: in adult, and even in basic education, students (*) may quite often be found accumulating vocational qualifications (turner plus milling-machine operator plus draughtsman). In some countries (eg France) it has become necessary to adopt legal provisions to put a stop to this uncontrolled pursuit of qualifications.

It must be pointed out, however, that such anomalies are partly the result of the rigid compartmentalisation of training courses which leaves the trainee no alternative but to begin the entire process all over again.

Instituting a common core (basic module) and grafting specialisation modules on to it is one attempt to meet the problem.

Sometimes, however, basic training includes an orientation cycle in which the student moves through several areas of training in rotation. Another object of this period may be, where induction is the chosen educational route, to isolate identical concepts shared by different technologies.

2.2 Polyvalence and basic training through in-depth study

I do not believe there is any clear-cut opposition between a polyvalent training and training in a specialisation. This has been confirmed by comparisons between the two.

As G Mialaret (1) has shown, specialisation need not be equated with the narrow, self-confined type of instruction ordinarily given on-the-job. Any training, broad or narrow, can generate "total" aptitudes provided that it is more than mere conditioning. It might even be said that there is less risk of confusion in the grasp of concepts, and hence of negative transfer, in specialist training than there is in the wrong sort of polyvalent training.

The variables which distinguish polyvalent from specialist training are institutional, cultural and pedagogical in origin, rather than categorical.

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(1) Mialaret (G): Introduction à la pédagogie, PUF, Paris, 1964.

(*) In this study, student, trainee and pupil are synonymous.

Take the cooper's trade, a minor branch: if it is taught on-the-job, haphazardly, its lack of appeal for young people, combined with the poor preparation of instructors, will assuredly produce mediocre results which will in turn give a negative connotation to the idea of both specialty and specialisation. But if some young people are found who happen to be interested in the cooper's trade, and if care is taken to cultivate and make possible, in the occupational situations encountered during training, the application of general aptitudes such as the organisation of work, choice of tools, reading of plans, use of formulae, etc, then I do not see why, all else being equal, this training should be less rewarding, in psychological terms, than some more "noble" specialised training or a polyvalent course. Perhaps only considerations which are external to the training system, such as task enlargement and inter-sectoral mobility - although their value may be open to question - could militate in favour of functional polyvalence.

2.3 Polyvalence and basic training through general education

The term "polytechnism" is sometimes found in place of "polyvalence". If it had not acquired a rather special meaning in Eastern Europe, similar to "introduction to technology (1)", I should prefer this term, for both semantic content and past history, to that of polyvalence. Polytechnism does suggest the idea of similar mental operations shared by several techniques, as in the case of general technology, technical drawing and descriptive geometry. These three last-named subjects, combined with civic education (preparation of the producer and citizen) formed the initial nucleus of instruction at the Ecole Polytechnique in Paris.

This idea of a basic training composed of general theories which open the door, deductively, to an understanding of all technical phenomena, has recently gained support from the evolution of knowledge (every technology is either gradually absorbed into the canon of pre-established sciences or itself acquires the status of a science), with the result that what used to be confined to particular apprenticeships is now being incorporated into general instruction. Metal-cutting, for example, was formerly divided up in various ways between the technologies of every trade in which metals are cut, but is now crowned by a general theory which forms part of the physics corpus.

Related to this is the view held by some authors, for whom a polyvalent base is everything which a group of training courses, although called by different names, have in common. Thus any common general training, any predominantly instrumental or theoretical instruction (mathematics, physics, building methodology) would come under basic occupational training just as in former years it was part of basic general education in intermediate non-vocational courses.

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(1) Deforge (Y) et al: The teaching of technology, Council of Europe, Strasbourg, CCC/EGT (72) 14, 1972.

2.4 Polyvalence and basic training through features in common

When occupational profiles are compared (using a single analysis grid), or, better still, descriptions of the role which an individual has to play in life, certain aptitudes, attitudes and types of knowledge are found to intersect. A basic training course could accordingly be built up from these convergences by enclosing the required natural abilities, attitudes to be developed and knowledge to be acquired within a single framework.

The contents of this framework can either be parcelled out throughout the entire course of training or presented as a unit in a basic course, which would then be polyvalent in the sense of the above heading.

We have described four ways in which polyvalence can supposedly be achieved, and given rough indications of the methods corresponding to each. Course contents are derived from objectives, and they in turn come from outside the training system - from social structures, or from production structures and knowledge of trainees' needs.

If the objectives of training are incompatible with its length, a choice must be made, on the basis of the initial situation (nature and level of trainee), the role which the trainee is desired to play in society (socio-political objectives), job characteristics (occupational objectives), pedagogical options (methods, role of institution), etc.

These considerations on the subject of basic occupational training would seem to imply that it depends to a very considerable degree upon circumstances external to the training situation, primarily the production structures.

3. Some ways of defining basic training

3.1 In terms of considerations external to the training system

3.1.1 Profiles (of jobs, trades, occupations, etc)

The most natural way of defining basic training from without would seem to be by reference to what is known about various trades. In a study entitled "Job classifications and common trunk training courses" (1) J Vincens shows how, starting from the ILO classification (ISCO) and other classifications and descriptions of occupational profiles, it is effectively possible to arrive at this common trunk in two phases: first, jobs must be broken down and compared to find what situations they have in common (most of these are manual occupations), and second, the trunk must be transformed into educational items. This method is sometimes followed in descriptions such as the American DOT system, where jobs are described in terms of the relations between data, people and things; but it does present difficulties.

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(1) Vincens (J): Job classifications and common trunk training courses, Council of Europe, Strasbourg, CCC/EGT (71) 126, 1971.

As Lantier observes (1), job profiles or monographs often refer to a highly Taylorised concept of the work post and take into consideration only that which corresponds to the worker's activity when performing the tasks enumerated in an ideally organised production system.

Such analyses have two weaknesses:

- They show only the shadows of activities, in terms which do not help to identify the underlying analogies which could go much farther towards building a base or common core than can surface similarities derived from denominations or task descriptions. For example, nothing points to the underlying kinship - and hence the possibility of a common base - between certain jobs in printing, weaving, and steel technology, whereas the processes involved in all three are continuous and their technologies identical.
- They treat all activities not included in the profile itself (unexpected replacements, aid to a colleague in difficulty, participation in trade union or social activities) as negligible or even anomalous in the production system.

As for nomenclatures of jobs and trades as the SEDOC (2) system, they do nothing but ratify and strengthen the division of jobs into major corporative families upheld by tradition, the state of production structures at one particular moment of history, and occupational examinations.

Although the concept of basic training centred upon occupational families (ordinarily characterised by the "material" worked, eg wood, iron, paper, the human body etc) readily lends itself to criticism, it is still, to my knowledge, the one most often adopted by course designers - with not very convincing results. The Council of Europe survey in seven countries (3), and those made by the EEC, indicate that groupings are consistent in neither dimensions nor justifications. Sometimes "common sense" is the reason given for putting together, on a "locksmith" base, the future locksmiths, boiler-makers, pipe fitters, welders and tinsmiths; sometimes it is an underlying analogy: the base "cutting machine operatives" groups together the future turners, millers, reamers and adjusters; and sometimes it is simply that the trades belong to the same corporation, as in the graphic arts. In one country "care of the body" is thought to belong in a common trunk with the services, but another believes it should go with the para-medical profession. This shows that division into families is often arbitrary and not based on any sound scientific foundation.

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(1) Lantier (F): See study below.

(2) SEDOC: Système européen de diffusion des offres et des demandes d'emploi, EEC, Luxembourg, no date.

(3) Council of Europe: Some significant experiments in vocational training, Council of Europe, Strasbourg, CCC/EGT (77) 31, 1977.

Efforts are being made, however, to devise methodologies which have abandoned such unitary descriptions of jobs and trades and are moving towards transversal groupings better suited to the concept of basic training courses.

The work of the CEREQ (described below) and the Training Services Agency ("job descriptors" (1)) is significant in this connection, although the results are obviously conditioned by the choice of descriptors and level of analysis. If descriptors are to be really different from job profiles or nomenclatures of occupational gestures, they must relate to significant sequences or sufficiently inclusive production situations, and they must indicate the mental processes underlying actions as well as the actions themselves.

If "tuning-up a motor", for instance, is a classic operation for a car mechanic, it is important to establish that "changing the spark plugs" proceeds from a diagnosis and that behind that diagnosis, as any other, lie the observation of symptoms, formulation of a hypothesis, testing of the hypothesis and possibly repetition of the whole cycle.

If we call this "problem-solving" and deduce from it that anything which contributes to the solution of a problem is preparation for the job of car mechanic, and for many other jobs, we have definitely placed ourselves at too high a level of generalisation. The formulation of hypotheses is conditioned by technological knowledge which, combined with the symptoms observed, restricts the hypotheses to those most plausible in the particular circumstances. Even so, drawing attention to psychological processes is of considerable help in the design of basic training courses.

It should be observed in passing that the "broad base-specialisation" system, which ostensibly intends to promote mobility and postpone selection, is not without its ambiguities, social as well as psychological and pedagogical, as witness the inconsistency of employers who sing the praises of pro-mobility measures such as broad-based training and polyvalence one day only to reject them the next, at the whim of circumstances. And then there are the trainees themselves who sometimes, as in Italy, want to begin specialist training right away; and the activist groups, as in Norway, which see broad-based training as a manoeuvre designed to make them more mobile and hence easier to manipulate.

This leads to a debate in which the attitudes towards broad-based training are dictated by oppositions of principle - one group refusing what the other proposes and vice versa - rather than by demonstrative argument.

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(1) HAMON (L.) : Job descriptors, A comparison of four developments, T.S.A., London.
These methods aim at obtaining, from the workers themselves, a description of their work situation as they see it.

As I said before, nothing that we know so far of the effects of broad-based training enables us to decide the question definitely one way or the other. At most, there may be a presumption in its favour on condition, of course, that the broad base is not just an assortment of bits and pieces taken from a number of different trades. Some educational psychologists actually believe that training which is specialised from the outset can be just as conducive to positive transfer as broad-based training (1).

3.1.2 Central occupations (*)

To escape from nomenclatures without replacing them by words such as "vocational axis" or "large families of trades", Kaiser and Werner (2) propose a novel approach based on the results of research on occupational flexibility.

Some types of initial training can be qualified as "central" or "intersecting" for they have a very high degree of overlap not only with one or two other courses but, after minor adjustments, with all other courses in the same general occupational field. For example, numerical data show that training in mechanical engineering occupies the most central position at the engineer-technician level, and that training for the occupations of smith, fitter and mechanic are most central to the mechanics occupations. This idea of central courses clearly leads to occupational basic training by a very different path from that of polyvalence (3).

The central position occupied by some training courses is well known to employment authorities, and can be explained by a dual convergence: occupations which are statistically central corresponds to training courses which are themselves central; but occupations which were but are no longer central (or which never were) can also lend themselves to central training courses because there is fortunately no rigid identity between the position of an occupation such as "fitter" in the employment market - as it can be described in the form of a statistical category - or its profile - as it can be analysed (and assuming that any fitters still exist) - and the "fitter" as a category in training.

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(1) Leon (A): Formation générale et apprentissage du métier, PUF, Paris, 1965.

(2) Mertens (D): Key qualifications in basic and further education, Council of Europe, Strasbourg, CCC/EES (72) 110, 1972.

Kaiser (M), Werner (M): See study below.

(3) Mertens (D): Survey of research on occupational flexibility, Council of Europe, Strasbourg, CCC/EES (72) 134, 1972.

(*) Method developed by the Institut für Arbeitsmarkt- und Berufsforschung (Institute for Employment Research) of the Bundesanstalt für Arbeit, Nuremberg, Federal Republic of Germany (see Kaiser-Werner study below).

From this approach we may draw one comforting conclusion: there is no need to invent new types of training courses which are syntheses or combinations of others, or to embark upon a painstaking search for "broad bases" or "common cores", for there already are a number of traditional training courses which may be affirmed, from the subsequent careers of their "products", to provide firm foundations or platforms for future development. We need only identify and make greater use of them.

The point about the training courses qualified as "peripheral", on the other hand, is that their trainees are confined to highly specific occupations where supply and demand must be very closely co-ordinated; surveying and diamond-cutting are examples.

We are not concerned here with an unconditional defence of traditional occupations, but rather with a process of reasoning which can be reconstructed as follows: since some forms of training, as can be seen from their trainees' later careers, offer a larger assortment than others of situations conducive to the use of a wide variety of models or action or understanding which can subsequently be applied in personal as well as occupational activities, then these are the kinds of training which should be encouraged.

3.1.3 By sequence of intervention (*)

The technocratic vision of a vast network which would compile and process data on employment and transmit it to an instantly-responsive training system may have been an attractive one but as G Ducray observes (1), "notwithstanding the improvement of information on job content and occupational mobility, it remains difficult to establish a close "fit" between training and job opportunities". The reason for this, apart from the hazards of forecasting, is that the link between job content and training content is neither direct nor simple.

As said above, the purpose of devising other approaches was to escape entirely from formulae based on statistics, nomenclatures or technologies.

Starting from the idea that there is a large share of creation and individual adaptation involved in training as well as at work, French research has discarded all deterministic, static formulae used to design training programmes which entailed no more than the reproduction of the situations identified on the job. The problem then became one of analysing work situations in such a way that the educator could, with the help of the analyses, work out a definition of the occupational objectives which his curriculum and teaching methods must be able to achieve.

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(1) Ducray (G): L'adéquation des formations aux débouchés en France, EEC, Brussels, 1976.

(*) Method developed by the Centre d'études et de recherches sur les qualifications, Paris, France (see Lantier paper below).

The procedure adopted is to isolate, in a firm seen as a socio-technical system, a working team (group of entities - things or people) among whose members exchanges of information have especially high intensity.

On the basis of the data compiled, a list of "sequences of intervention" is drawn up without regard for considerations of trade (métier), technology or level; the next step is to determine which work situations are similar and which dissimilar. To do this, the results are interpreted in relation to 6, 7 or 8 criteria. All activities at similar "distances" from the 6, 7 or 8 criteria form a "constellation" of situations for which a single training course will be suitable.

As we can see, it is possible with this approach to assemble under one head (which need be no more than a number, as the data are computer-processed, of course) a number of blocks of skills which, after treatment by educators, can be translated into basic training courses, specialisation modules, or complete training units.

3.1.4 By analysis of man-reality systems

The ground for objection to the methods described above (*) is that their point of departure is an analysis of situations linked to occupational activities. But these are not the only situations with which a person has to deal in his interaction with reality, so the occupational situations should be supplemented by what I have called existential situations. These include relations with other people and the solving of problems which are not wholly occupational, although the distinction is not always very sharp (1). For example, one may query whether a relationship with another person is an occupational or an existential situation, and whether the subject applies the same model indiscriminately to both.

Analysis of man-reality systems includes analysis of the production system and hence of the work post, job, etc; but it transcends this framework to embrace social relations as well, following the same method as for work post analysis: observation, census-taking, compilation etc.

This provides nothing but the raw material. The models for dealing with situations have still to be devised; and it is here that a number of very fundamental questions arise, far more insistently than in connection with exclusively occupational situations.

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(1) The CRAMP approach to the teaching of social skills and life skills, Industrial Training Research Unit, Cambridge, United Kingdom, 1976.

(*) And of which fuller particulars will be given further on.

Let us suppose that "sharpening a tool for a specific job and mounting it on a machine" is representative of a set of occupational situations. This will give the following training objective: "to make the student capable of ... ", which will be a simple replica of the occupational situation. By means of recursive analysis and a few educational hypotheses, it will be possible, depending upon the individual, circumstances and conditions of learning, to draw a progress graph moving from the lowest levels of knowledge about the subject through a series of knots (and check-points) to "the student is capable of ... ".

Nevertheless, even though it may not be expressed as an objective, there is still agreement as to the ultimate purpose: "to make the student capable of working correctly where he is employed". It is difficult to imagine what manner of training would boast of teaching students how to break their tools.

Now let us suppose that "relating to a superior" is representative of the group of existential situations. It is very hard even to describe such situations without referring to social and moral values; but supposing that it could be done, we have still to see how a student could be taught to master such a situation.

If education is a generalised capacity to handle all kinds of situations, analysis of the man-reality system should provide a foundation for a true education based on action models, some having recourse only to aptitudes inscribed in the person's genetic substratum and others, such as that required by mastery of the situation cited as an example, ultimately necessitating recourse to normative criteria. It would appear neither possible nor desirable to provide neutral models or to put certain situations "between parentheses", for education would cease to have any meaning. I am strongly of the opinion that education cannot be neutral; any education is a more or less surreptitious form of imposition. We must make a choice. Two extreme models can then be devised, one making the student "capable of being on 'good terms' with the hierarchy" (reference to the notions of good workman, good father, good citizen) and other making him "capable of maintaining a relationship of force with the hierarchy".

In short, either the description of the situations incorporates an option related to the objectives of society with its present hierarchies and values; or the situations are made as neutral as possible and the educational system must then choose how to deal with them by adopting some option relating to a hypothetical future; or, and this is the case most frequently encountered nowadays, a sort of confused dynamics develops in which the objectives of society, employers and educational system all clash to the great detriment of the students who can no longer see where the real values lie.

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Another problem: how, starting from the recursive analysis advocated here, does one compose a basic training course? Should a small number of situations be selected and dealt with, leaving the rest for another level, or should all be covered superficially but without going deeply into any?

Assuming that we can produce a consistent enumeration of occupational and existential situations suitable for use in a basic training course, the educational institution can then try to infuse it with its own objectives, derived either from its educational or political ideology (when it has one) or from considerations of educational psychology (maturity, antecedents, system of representation, etc).

This leads to concepts of cognitive structures, aptitudes per se, conceptual levels etc: in other words, the whole psychological dimension comes into play; and the inter-action of these various factors produces what I call objectives and methods for attaining them.

3.2 In terms of considerations within the training system

3.2.1 Stage theory

In his presentation of a method for drawing up a list of capacities relevant to basic training, J L Chancerel (1) (2), proposes a series of basic psychological processes covering the affective, cognitive and psychomotor fields. If a natural taxonomy of such psychological processes existed, this would clearly form the backbone for a basic training course; but as J B Grize points out (3), the stage theory, although highly relevant to childhood as we know, does not "transfer" to adolescence. Serious anomalies have been seen, of course, in both adolescents and adults, but these are only accidents in a genetic process which, in the educational and social context of our societies, has normally led to the mastery of hypothetical-deductive reasoning and the associated psychological processes by the end of childhood.

Further work would seem necessary, on the other hand, on the pedagogy of object-building. J B Grize concludes that from adolescence on, learning involves not the building of new thought structures but the structuring of the objects of learning.

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(1) Chancerel (J L): Key qualifications and basic training in vocational education, Council of Europe, Strasbourg, CCC/EGT (77) Misc 2, 1977.

(2) Chancerel (J L): Propositions pour une méthodologie d'établissement d'une list des capacités, University of Neuchâtel, Switzerland, 1977.

(3) Grize (J B): Note sur les thèmes de discussion du groupe "formation de base", Council of Europe, unpublished, 1977.

It would thus seem appropriate to turn to the concepts of situations and data, the former being taken to mean all objects of knowledge and action external to the subject and the latter, all of the subject's perceptions.

3.2.2 Data structuring

A subject's activity is based on operational aptitudes which have ordinarily been acquired at the age with which we are concerned. (It has been said that the pre-vocational stage was operator-centred and the vocational operation-centred.) But then, taking data as the raw material and operational aptitudes as the tool for transforming it, he must also be able to construct knowledge or action models corresponding to situations, occupational or other.

We accept that mastery of situations may be obtained in three ways:

- by the direct use of pre-structured data, which is usually given; the subject's activity consists in applying to one situation a memorised model relating to it: knowing how to do something, algorithm, ready-made formula, etc;
- by the partial reutilisation of memorised, structured data: the subject's activity consists in transferring a model from one situation to another. Depending on the quality of the model (and the transfer), the operation is more or less successful, more or less hazardous;
- by an original structuring of data: the subject's activity consists in obtaining, sifting and handling data so as to construct an explanatory or action model relevant to a situation;
- mastery of a situation implies the acquisition of an adequate language, verbal or not, which is required to build the models.

In training, the first way is not to be sneered at when the object is instant effectiveness. Students are action-programmed; this is the military mode of instruction - how to take a gun apart and put it together again.

It can also be actually necessary, in what might be called "closed" situations which must be dealt with unhesitatingly by following instructions.

Educationally, this may be interpreted as follows: when confronted with a new situation, the student receives instructions or technical notes intended to enable him to succeed immediately.

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It must be pointed out that although this method of achieving an end is effective in many cases, it is psychologically deleterious. The models it can produce are weak, they cannot be detached from the action and they adhere to the situation. To move beyond this point a language is needed - that is, the student must reach a symbolic level at which he can operate upon symbols and deal with similar situations by restructuring and transfer of models.

Many studies on learning transfer have shown that the acquisition of a strong model such as a general law opens the way to mastery of a greater number of situations, even though the intervals before response may be longer. But consistency must be maintained between the strength of the model, the type of situation, and the mastery of a language. This leads me to offer one or two pedagogical comments which may be relevant to basic training.

It has long been known that a given situation may be mastered by applying several more or less efficient, more or less durable and more or less general action or explanation models.

The most current example is that of scientific theories, which are sometimes conflicting (geocentric and heliocentric models; the numerous atomic models) and sometimes complementary (in engineering or electricity there are many examples of imbricated mathematical models which become increasingly refined or in which parameters omitted from previous formulations are subsequently incorporated).

In so far as this outline corresponds to a natural thought process (a general explanation preceding particularisation), it can be applied to basic training in the form of a simplified model which is later supplemented by specialised training. This is a feasible procedure so long as care is taken to emphasise the continuity and consistency of models.

To avoid conflicts between cognitive structures, it is of primary importance to ensure continuity between explanatory models. When teaching the rudiments of electricity in basic training, for example, the hydraulic model may seem the simplest to use because it is easily understood by students and highly illustrative. But it soon proves deficient and can conflict with the more elaborate models required for the understanding of all electrical phenomena. It is therefore better to make the added pedagogical effort and employ a single model which becomes more complicated as the student progresses.

With regard to consistency, it has been demonstrated that the students who can solve a technical problem such as taking up play in a machine or rough-planing a vice (1) fall into three groups: those who apply a general model (rule of general law);

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(1) Leon (A): Formation générale et apprentissage du métier, PUF, Paris, 1965.

those who apply a practical model (based on stereotypes of the actions to be performed) and those who apply an informal model (based on specific signals, sounds, movements, appearances). As we might expect, those in the first group are the ones who obtain the best results in a variety of circumstances, that is, who can transfer or recover the model in the best conditions.

There must also be consistency in language. Situations which are fundamentally identical must be presented the same way in physics, in technology and in the workshop. The conflict between the major mode of rational explanation employed in technology, and the minor mode of intuitive grasp which is sometimes employed in occupational practice, generates disparate models and prolongs the subordinate status of the latter.

Conversely, a model's "validity limits" must be made known, so as to avoid inoperative transfers. In turning out the same piece, the miller will obviously not follow the same action pattern as the fitter.

This shows the importance of a general technology which provides rational models in basic training, and the value of educational approaches designed to establish a general model for particular situations and multiple applications.

So far we have been referring to models for "closed" situations only, but there are others - a large number, in both technical and existential fields - which may be qualified as "open" and cannot be dealt with by means of established models.

In this case there are two possible attitudes to adopt: open situations may be reduced to the dimensions of closed situations by eliminating some part of their "degree of freedom", or in other words by introducing additional restrictions; or a set of instruments for dealing with such situations may be supplied, complete with a method for their use (the art of model-building) and selection criteria.

At this point such concepts come into play as that of fundamental capacities, aptitudes for problem-solving and data-processing, conceptualisation, structuring etc, which relate to the psychological processes set in motion to respond to open situations.

The second proposition is plainly more attractive than the first. It can be carried too far in education, however, when all situations are presented as open and all models are systematically "rediscovered" (rediscovery method).

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I used to think (1) it was possible to present abstract situations - games and various simulations - on which general models could be built.

Learning by simulation is certainly a valid teaching method and one of which insufficient use is made in training although it is commonly found elsewhere, especially in school workshops which are nothing more than simulations of actual workshops.

It would be a mistake, however, not to exploit the realistic situations which may arise in the course of training.

For one thing, they are the ones which the student can best employ as a basis for his problem-solving models, provided that he is effectively participating in his own training. For another, a choice or decision which refers to a system of normative values is ultimately required to resolve the indeterminateness of open situations in reality.

In simulations, such choices have no real consequences. But if the open situations arise out of the working of the institution or out of a decision to produce and sell, the choices commit those who make them.

To sum up, learning consists in the building of models in different situations. The important thing is the removal of action to a certain distance, the autonomous construction of models which will be effective over a broad range, and the possession of an attitude-generating system of values.

I think it is for the system to offer a wide spread of situations, for the trainer to choose those he knows and has mastered, for the instructor to make the best use of the pupil's possibilities, and for the teacher to be a conveyor of values in which he believes.

In this sense, basic training is defined by the structure of the institution, the training and capacities of its staff - who are trainers, instructors and educators all at once - and by its duration, rather than by imposed curricula and objectives.

In basic training the manner is more important than the matter. This re-transfer to the institution and teachers (through their training and options) of responsibility for defining basic training in terms of pedagogical acts may appear reactionary in our age of cybernetic education with its rationally defined objectives and methodical evaluations. But I am so firmly convinced that the educational situation has never been and never can be a closed one, in which the same model can be right for everyone, that I am by no means opposed to it.

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(1) Deforge (Y): Lecture on school workshop equipment, Council of Europe, Strasbourg, DECS/EGT (72) 86, 1972.

Only a teacher - a human being and not a teaching "machine" - can consider each student as a unique whole and lead him to the highest development of his potential within the time at his disposal.

Another conclusion is that occupational basic training, so conceived, cannot be an omnibus model to be thrust indiscriminately and unmodified upon every individual with learning difficulties.

3.2.2 Curricula

If we agree that curricula and instruction are the outcome of more or less open negotiation between the parties concerned (ministry, management, wage-earners, teachers and possibly parents and students) and that as such they contain both explicit and implicit objectives, describe situations and provide models for dealing with them, recommend - or not - the search for open-ended situations, establish periods and conditions for evaluation etc, then we can try to delineate basic training by comparing different curricula and seeing what they have in common, although we cannot be certain that what they have in common is fundamental to them or that our comparisons are not falsified by differences in expression.

M Schmiel has devised analyses of this type (congruence analysis) for apprenticeship regulations for skilled occupations in the Federal Republic of Germany (1). This is a monumental work, but its author concedes that the chief result of his analyses has been to reveal some very surprising inconsistencies in terms of what should or might form a basic training course.

Even if the profile of a basic training course could be drawn from such analyses (as has been done for languages with the "threshold level" and in other subjects such as technical drawing), the particular objectives and contents of such a course are seldom expressed in curricula, since basic occupational training does not form a separate entity in classical course design.

In any event, these analyses bring us back to the role of the teachers and institutions responsible for transmitting training to pupils, and to that of the society into which they are received.

3.2.3 Results

Following a line of reasoning somewhat similar to that relating to central occupations - except that in this instance the training system is a "black box" - we can study the subsequent behaviour of its "products" and qualify the system solely in terms of its immediate or long-term results.

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(1) Schmiel (M): Deckungsanalysen der Ausbildungordnung von Ausbildungsberufen, IAB, Nuremberg, 1976.

Here, the criteria for evaluating the effectiveness of a system would be the following (1):

- percentage of trainees in employment at time of survey;
- length of period spent looking for first job;
- geographical mobility (% outside training region);
- correspondence (or absence thereof) of type of training to actual job;
- level of remuneration;
- occupational classification on first employment.

Another approach entails the observation of certain schools offering one or another type of training, which have long been noted for turning out competent, progressive and responsible people, without it being clear whether this is to be attributed to the teaching staff, method of recruitment, institution, methods or contents of courses, or a felicitous mixture of them all.

After identifying such systems, as we did in our surveys (2) (see especially that on the Artigianelli Vocational Training Centre, Reggio Emilia), the next task was to analyse the reasons for their success. These are often rather subtle: in one place they will have to do with the type of training, in another it will be the operation of the institution, and in a third the quality of student recruitment - but in every instance we find the enthusiasm and faith of a team or a single man who believes in what he is doing. Furthermore, as basic training is seldom the end of the process (most often it is only the first year of training), it is difficult to dissociate it from what comes later and to make even a qualitative assessment of its intrinsic effects.

In addition to the examples of systems or institutions which have produced outstanding results to be found in the history of education and technical education in particular (Makarenko and his "pedagogical poem" may be mentioned here in passing), I should like to refer to one from my own experience. In my work as inspector of technical education, I was struck by the human and professional qualities of a particular group who had all attended the same school. I asked them to what they attributed their success, and the reply they most often gave was, "to the metrology classes we had at school". This was a plausible answer, for metrology - little-known at the time - cultivates general aptitudes (care, attention, experimental precision) which can be a boon in many circumstances.

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(1) EEC: Evaluation de l'efficacité de la formation professionnelle, EEC Commission, Brussels, 1976. See also the "indicators" in the questionnaire in the document under (2) (CCC/EGT (77) 31).

(2) CE: Some significant experiments in vocational training, Council of Europe, Strasbourg, CCC/EGT (77) 31, 1977.

I therefore designed a metrology course for technical instructors, I taught the course, and I installed metrology laboratories in several vocational schools. The results could not be considered significant, however, in comparison with training courses in which the subject was not taught.

I went back to the source for further information, and found that the success of the graduates of that particular school was primarily the work of one man (its director) who had succeeded in imposing a style upon his school, his teachers and students.

Of course, these evaluations of the quality of a training course depend upon the level of and criteria applied in analysis. A training which I call "good", by reference to my own criteria and particular level of socio-political analysis, may prove, when examined in relation to different criteria, to be "alienating". But I said before that all training systems were founded, implicitly or explicitly, on a social behaviour model.

This model is easily discernible in what I call the "charter for technical and vocational education" (1), and also in our conclusions, where we list some of the features of a "good" occupational basic training.

4. Conclusion

Ideally, in planning a basic training course:

- It is unwise to refer to traditional occupational hierarchies and denominations;
- It is unwise to attempt to make it contain the worker's "minimum for survival". Basic training does not relate to the tasks of the semi-skilled worker in the way that full training corresponds to those of the skilled worker;
- It is not necessary to refer to the occupational situations of the present moment, for these will be assimilated at the level of specialisation;
- On the other hand, one can refer to certain trades which offer a wider variety of situations than others and are therefore centrally placed in relation to a constellation of concepts or models;
- Using a suitable methodology, one can equally well produce an assemblage of situations whose common feature is not the practice of any particular trade.

Basic training should seek:

- To develop spoken and written language and graphic expression;

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(1) Deforge (Y): Interim Report by the Programme Adviser, Council of Europe, Strasbourg, CCC/EGT (76) 27, 1976, pages 34-35.

- To inculcate the main technical concepts: material, tool, machine, modes of obtaining forms, processes;
- To train students to produce models starting from exemplary situations (technical and existential paradigms).

Basic training must be adaptable and:

- Strengthen basic aptitudes, as well as reactivate previous knowledge;
- Vary in length (from six months to one year).

The educational method used in basic training should be inductive:

- It is not necessary to employ a facilitating technique (such as simulation) to prepare for the formation of strong concepts or models;
- Efficient concepts and models will rather be built on a foundation of a variety of situations and practice in thinking about those situations.

By inductive teaching, the operational is born from the conjunctural.

Open situations should be dealt with by reference to a system of established values.

To conclude:

- The reply to the question "What is basic training?" appears, from within, to derive from considerations which are pedagogical and institutional in origin, rather than methodological (research and qualifications), taxonomic (classification or hierarchy of aptitudes) or even psychological.
- A good basic training is one which makes the pupil aware of the general validity of his intellectual operations, beyond the concrete situations with which he is confronted.
- A good basic training is one which, through its institutional working, provides qualifications for living.
- A good basic training is one which motivates the pupil and gives him an appetite for action for the future.
- A good basic training is one which can be extended in other courses - specialisation and permanent education - by the use of acquired skills, primarily the capacity for learning.

In this hypothesis, the sound values are not a list of qualifications or carefully defined contents, but the competences of the teaching staff, the structure of the institution and the basic features of society.

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II. SYSTEMATIC ANALYSIS APPLIED TO THE CONCEPTION OF A BASIC OCCUPATIONAL TRAINING COURSE (*)

J L Chancerel, Y Deforge

1. Qualifications, skills and educational objectives

1.1 Qualifications

We speak of qualifications in reference to the organisation of work. A qualified person is one who possesses the skills needed to occupy a specific job. Qualification is established by a person's past experience, school or working record, and/or performance on tests and examinations.

The hierachy of qualifications (often established by conventions between management and workers) regulates various aspects of staff management: classification, attribution, pay, basic and further training.

Qualification is linked to a production structure but expresses only its most obvious dimension, the economic.

Mertens, however, has established (1) that the association "qualification of employment - qualified person" was not as rigid as might be supposed and that in some circumstances production structures were more flexible than in others.

Furthermore, the surveys which are discussed at greater length below (2), show that some qualifications - those known as "key-qualifications" - cover several distinct qualifications.

This leaves no alternative but to try to find out, by means of analysis, which skills are implicit in the qualifications.

1.2 Skills and educational objectives

a. Skills: This refers to learning, the ability to do or ability to be, expressed in terms of "he is capable of ...". Hence, it is the expression, in a given situation, of a widely applicable, observable and measurable learned behaviour.

Skills emerge from a dual analysis:

- of production structures: the ability to handle occupational situations;
- of social structures: the ability to handle existential situations.

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(1) Mertens (D): op. cit. supra.

(2) Kaiser (M): see study below.

(*) The theoretical statements made here are enlarged upon and illustrated in the third publication on "occupational basic training".

The problems are:

- to find a means of describing situations which is not merely a reproduction of qualifications;
- to develop a vocabulary for expressing skills;
- to find a level of analysis at which skills can be stated in terms neither too broad (to be capable of earning a living) nor too narrow (to be capable of dialling a telephone number);
- to determine which skills can be used in handling both existential and occupational situations (is a man automatically a good citizen because he is a good mason).

b. Educational objectives: We speak of educational (or pedagogical) objectives in relation to acquisition (learning) structures; according to Mager (1) they specify what the student should be capable of doing in terms of observable behaviour. "Performance, proof that the objective has been achieved, must perforce be observable and, if possible, recordable."

This implies that an objective is "an intention communicated by a statement describing the change to be brought about in the student - a statement specifying how the student is to be changed after successfully completing a given course of instruction".

An objective is defined by:

- an action, ie a behaviour;
- a content: the action has an observable content:
- a situation: the behaviour must be shown in a particular situation;
- one or more criteria: in order to determine whether objectives have been reached, it is necessary to devise criteria for deciding whether the behaviour does or does not correspond to the definition, in terms of action, content and situation.

c. Relations between skills and objectives:

- Skills must be acquired (learned).
  They serve to deal with situations which are determined by structures; they produce behaviours or activities.
- Objectives must be achieved.
  To this end the student is presented with learning situations and methods determined by learning structures.

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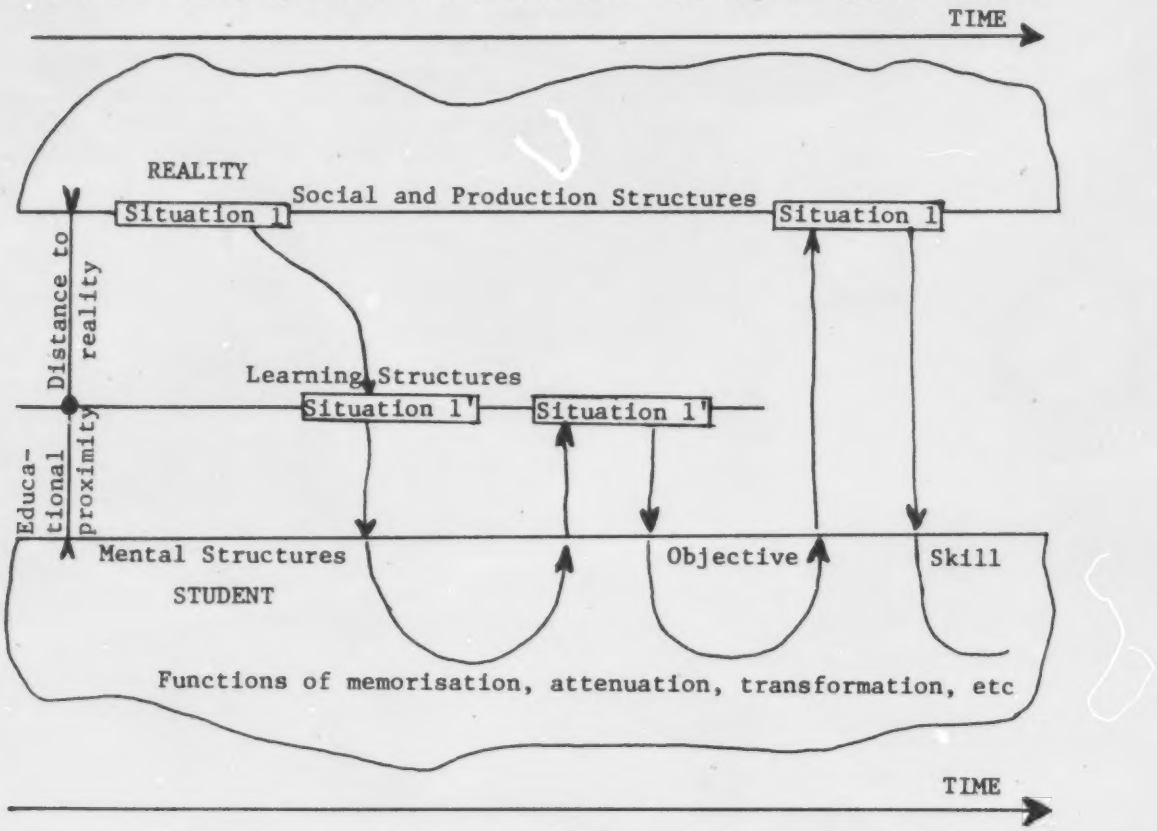
(1) Mager (M): Vers une définition des objectifs pédagogiques, Gauthier-Villard, Paris, 1968.

Both skills and objectives are defined in terms of "being capable of", but the former are expressed in "real life" (the man-reality interface) whereas the latter exist in the more or less abstract world of learning structures.

The two may correspond completely, or in part, or they may differ widely. In any case, each can be defined only in relation to the other, by their relative consistency or distortions.



We also say that learning structures have objectives which differ widely from or are very close to those of society; that they prepare people well, badly, narrowly, to handle occupational situations; that they "reproduce" occupational situations too closely or are too remote from them, etc.

The fundamental structure or envelope is particular vision of society, realistic and immediate, futuristic, possible or utopian.

I have shown this in my description of four models of society (1) deduced from three systems - of learning, production and consumption (of goods and knowledge).

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(1) Deforge (Y): Interim Report by the Programme Adviser, Council of Europe, Strasbourg, CCC/EGT (76) 27 (pages 16-18).

1.3 Systems and sub-systems

a. A few model types:

MODEL OF SOCIETY	Learning sub-system Education - training	Production sub-system Employment structure	Consumption sub-system Social demand
INDUSTRIAL SOCIETY ("LIBERAL" CAPITALISM)	- Mass education - Preparation for leisure activities - Permanent education	- Little evolution in structures - Automation - Less time spent at work	- Leisure activities - wages - Access to jobs higher up the ladder
SOCIAL WELFARE SOCIETY Evolution without revolution towards a society of the "Scandinavian" type	- Permanent (non-voational) education - Individualisation	- Expansion of "social tasks" sector - Job restructuring - Task enlargement	- Concept of the social function of the individual - Equalitarian social status - Housing, town planning
INDUSTRIAL (SOCIALIST) SOCIETY Planned welfare	- Integration of individual in group - Ideological education	- Same structure as in capitalist societies - A place for everyone and everyone in his place	- Class solidarity - Co-management
LIBERTARIAN SOCIALIST SOCIETY Decentralisation of decisions Rejection of technocratic choices Faith in creativity	- Deschooling - Co-education	- Rejection of consumer society model and of concept of productivity	- Direct and participative democracy - Self-management

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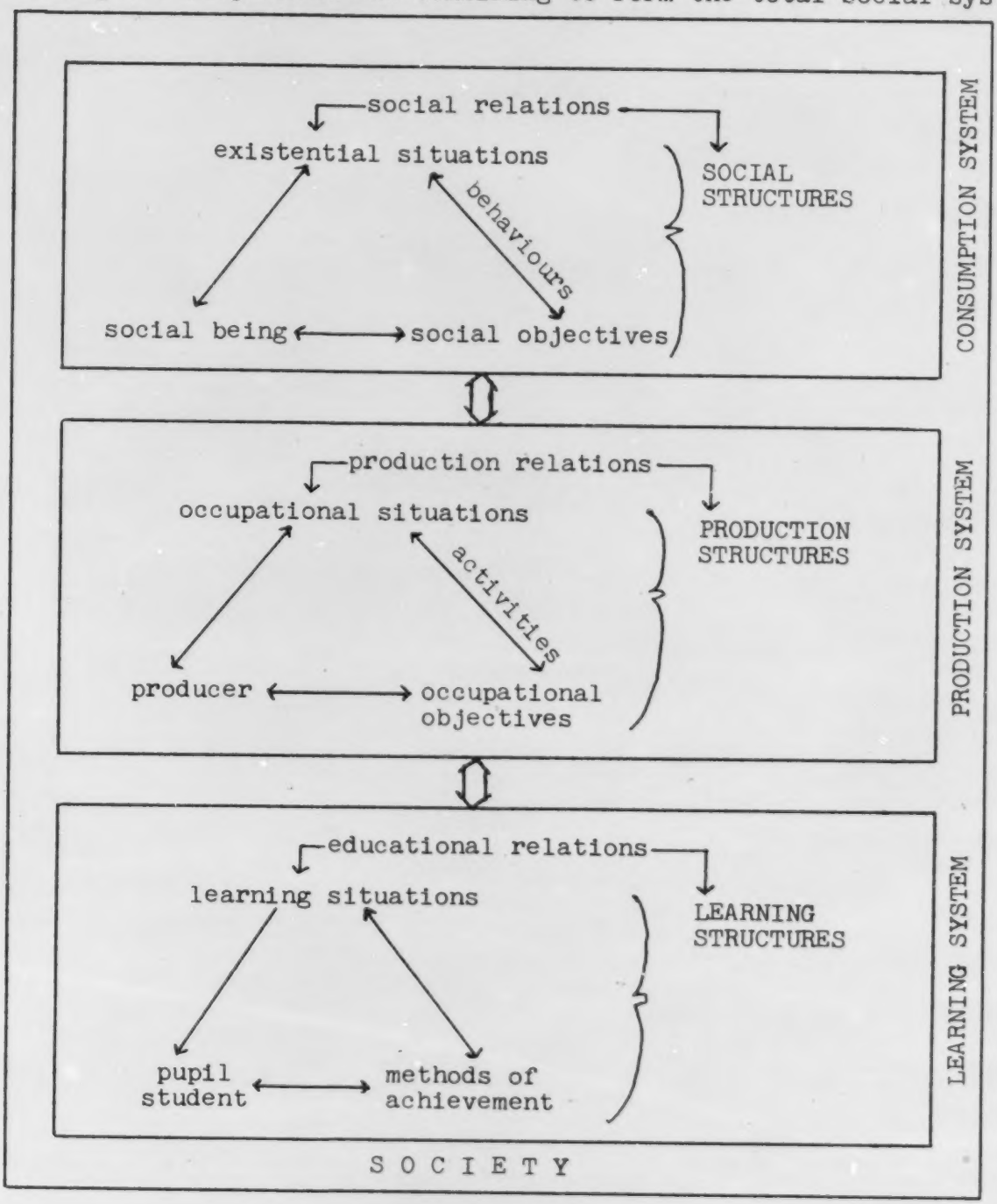
b. Levels of analysis of a system:

Artificial as the analysis of such complex systems as those listed above may be, it is an intellectual and methodological necessity.

The three inter-related sub-systems provide three levels of structure analysis: learning, production and social, all three being interdependent and combining to form the total social system.



This system can be "read" in an infinite number of ways:

- A person responds to an (occupational) situation with (occupational) activities mobilising (occupational) skills and thereby creates (production) relationships with (production) structures;
- A (production) structure implies a particular type of organisation (of production relationships) and thus of (occupational) situations demanding response in the form of (occupational) activity by an appropriate person (producer) possessing (occupational) skills;
- A (production) structure reacts upon (learning) and (social) structures;
- and so forth.

Every term in the proposition is interchangeable, and every relationship can be analysed. We shall look at the most significant ones.

2. Analysis by level

Each level can be analysed under three headings: situations, structures and skill-based behaviours.

2.1 The level of learning structures

a. Structures

The object of analysing learning structures is to describe the form and effects of institutions.

For this purpose, the Council of Europe has devised a grid for the analysis of training systems (1) and tested it on a small number of systems (2).

Two difficulties arose; both are fundamental and offer sufficient reason in themselves for more exhaustive analyses or different instruments:

1. Objectives are seldom expressed in the terms of the definition under 1.2.b above and some are obscured, deliberately or not.

2. The criteria for determing whether objectives have been achieved (written exams, practical tests) produce a classification within the sub-system which is not consistent with results at the occupational and social levels, in so far as they can be known at this stage (problems of follow-up of trainees and disruption resulting from the economic crisis).

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(1) CE: Survey questionnaire, Council of Europe, Strasbourg, CCC/EGT (76) Misc 36, 1976

(2) CE: Some significant experiments in vocational training, Council of Europe, Strasbourg, CCC/EGT (77) 31, 1977

I have selected the following characteristics as major indicators:

- degree of participation of parties concerned in the definition of objectives; it ranges from imposed technocratic definition to self-management. This is a decisive factor in the consideration given to the needs of the different parties. In the actual working of the system, participation is also an educational instrument, with an influence upon methods of achievement. Without participation, any talk of autonomy is meaningless. Participation implies an ability to speak from one's social position (membership). Also, the entire institution must be in a position to give due consideration to what is said.
- degree of freedom from unities of time, place and action: the "unit/credit" modular systems offer an example of a departure from the rule of the unities.
- consideration of social demand and individual needs
- adjustability in response to results
- sensitivity to outside change
- durability of skills acquired by achievement of objectives.

b. Situations

Learning situations may be highly realistic, have an "abstract reality" (simulation), or show no visible kinship with social and production situations. The shift from learning to social and production situations (and the ability to handle them) always necessitates a transfer (in the pyschological sense of the word) of varying intensity.

For present purposes, learning situations include the traditional resources, such as classes, books, exercises, problems and practical activities, but also whatever learning situations may arise through the life of the institution. Pupil participation in class councils, for example, is a simulation which prepares people (possibly) to deal with similar existential (and occupational) situations.

Comparison of the results of learning structure analysis with those of learning situation analysis shows the relations between the two and serves as a basis for one type of educational relationship.

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c. Achievement methods

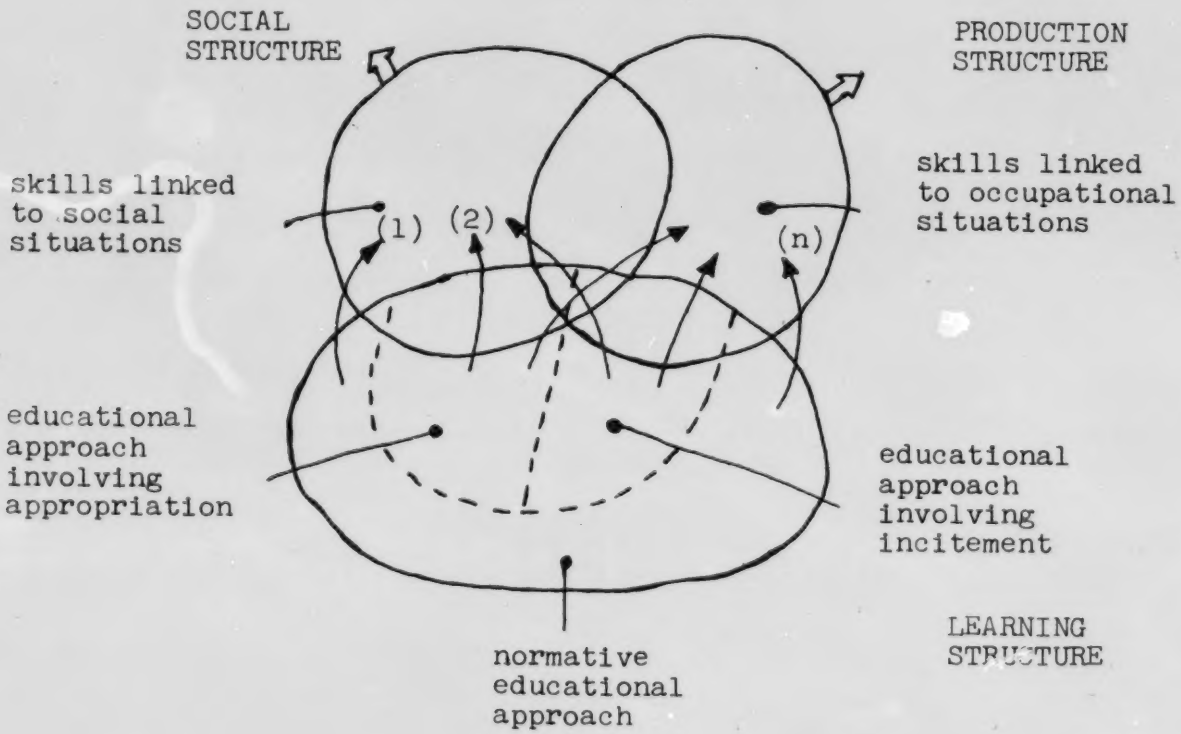
Following Lesne (1), I shall look at three educational approaches leading to three main methods of achieving objectives:

- transitive, with a normative orientation. This is a process of inculcation and imposition, in which the teacher possesses all knowledge and power.
- pupil-oriented. This involves intervention at the level of learning processes, the object being to generate activity in the pupil in response to learning problems.
- appropriative, centred upon the socialisation of the individual. Here the pupil is regarded as an agent of social change.

Depending upon the educational approach, the pupil will develop different methods for achieving objectives. In other words, the skills acquired will not be the same in number, scope or nature.

It is neither desirable nor possible to avoid using all three of these major approaches to the achievement of objectives, but occupational basic training should concentrate on the methods derived from the second and third, for it is they which can confer the greatest autonomy.

In a basic training course, skills can be represented graphically. The arrows (1), (2) ... (n) stand for learned methods of achievement (skills).



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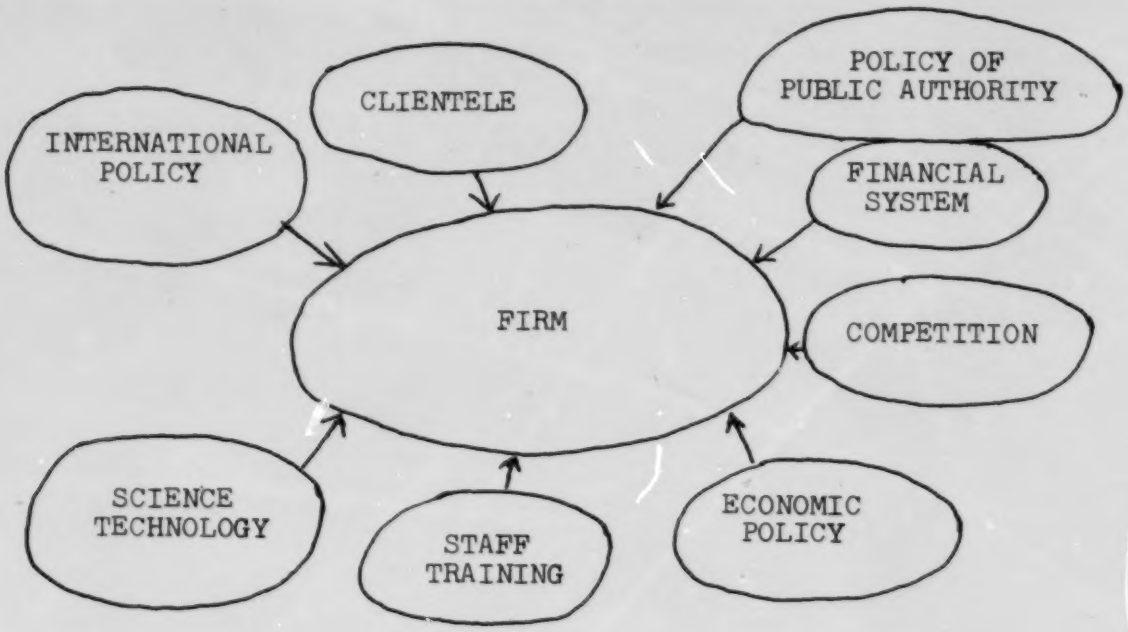
(1) Lesne (M): Travail pédagogique et formation d'adultes, PUF, Paris, 1977.

2.2 The level of production structures

a. Structures

1. Limitation of systems:

The study of a production system, like any other, requires that its limits be defined (individual, group, firm, group of firms), after which significant external influences can be catalogued (1).



2. Organisational diagram:

The most obvious expression of production structures is the organisational diagram which shows the hierarchy, the functions of groups and individuals and the functional relations between them.

Such diagrams may be clarified by an investigation of the following:

- distribution of power;
- decision-making procedures;
- communications systems and their institutionalisation;
- organisation of employees (trade unions);
- role expectations and standards applied;
- foreseeable development of the system;
- and so on.

3. Condition of the system:

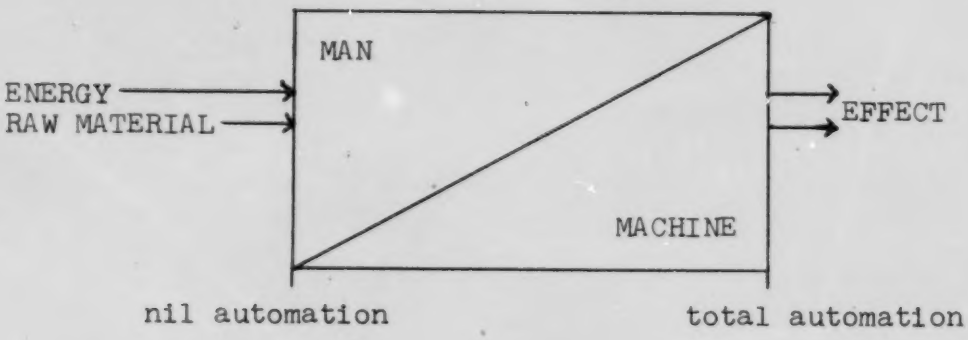
With regard to general typology, two main structures may be distinguished.

(1) Deforge (Y): Interim report, op. cit., 1976 (pages 16-18).

- Those subject to powerful outside forces, where a large number of causal actions take place which are not subject to control by the individual or collective wills of the persons affected. This is the typical condition of the large over-structured and over-conditioned firm.
- Looser structures showing less directivism, in which there is some room for the expression of people's wills (open situations). This is the typical condition of small craft industries, and of others when not subject to too much pressure from without.

At the individual level - that of the artificially isolated productive system - the man-machine association is commonly regarded as primary.

MAN-REALITY SYSTEM



The functions performed by the man-machine association may be reduced to six:

- ultimate purpose of the system;
- transformation of energy;
- initial decision;
- action programme;
- guidance;
- technology of system.

By determining the relative participation of each member of the association it is possible to devise a typology for man-machine systems. At nil automation the man performs all the functions, at total automation the machine has assimilated them all.

b. Situations

For many years, work posts or trade profiles were described simply by enumerating the tasks to be performed by a worker in a standard organisation (*).

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(*) Cf. introduction and Lantier paper below.

Because it refers to an ideal organisation, this type of analysis produces an artificial and restrictive list of occupational situations. It gives little information about the skills needed, for "the mere enumeration of tasks pertaining to a given job leads to a description of a wide variety of work posts or combinations of tasks resulting from different divisions of labour, but provides no information as to the qualifications required to fill those posts".

The problem, thus, was to invent a method which could catalogue the skills used in work situations, based either on the present classification or some other one which would completely abandon the standard organisation and reference to qualifications (1).

c. Objectives:

Research is now seeking to devise job descriptors identifying the skills which different occupational situations have in common.

The Training Service Agency (2) has made a comparative analysis of four lists of descriptors, the TDT ITB system's Unit Initial Skill-Element List (113 items), the General Skills Questionnaire (226 items), the Position Analysis Questionnaire (PAQ) (194 items) and the RBL descriptive system (183 items).

As their titles indicate, all these questionnaires are intended, inter alia, to lead to the reorganisation of skills into units or modules found in a large number of occupational situations requiring the same skills.

The skills covered by descriptors are grouped into families, eg:

- communication, various forms
- mathematics and reckoning
- organisation
- reasoning
- interpersonal relations
- perception and use of senses
- processes of estimation
- physical characteristics
- performances
- demands of presentation
- temperament
- characteristics of work
- dangers
- use of data.

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(1) CEREQ: Répertoire français des emplois, présentation générale, 1977.

(2) Hamon (L): op. cit.

Each item in a family is assigned a place on a scale.

Thus the job profile is replaced by a skills profile; the basic skills to be developed during training are those occurring with equal intensity in a large number of profiles. The learning situations need not correspond exactly to those found in a specific trade but may be any which mobilise the relevant skills.

But, although such analyses differ from job profiles they still bear a relationship to them, because the skills are defined after observation or questioning of a worker in his work situation in an established production structure.

It is also possible, as the CEREQ has done (*), to compare the results of production structure analyses with those of work situation analyses, using some grid other than qualifications in such a way as to reveal the true production relations.

- At the structural level, descriptive data supply numerical indications about a population of observed individuals and concrete particulars about the firm and conditions;
- At the situational level, characteristic data or classifying variables; applied to a variety of work situations they reveal those which possess a sufficient number of identical features to be filled by the same person.

Using this approach it is possible to transform observations of work into model occupations. A model occupation may be defined as a group of work situations which are sufficiently closely related in terms of:

- the field of action (extension of individual activity in relation to the general organisation of the firm);
- nature and level of action;
- field of specialisation defined in reference to a body of knowledge or techniques used in performing that action.

Thus, occupational situations are regarded as analogous when capable, from the three above points of view, of being filled by the same person, without considering any circumstances specific to the firm or branch.

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(*) See Lantier below.

2.3 The level of social structures

We find the same levels of analysis as before:

- the concept of social role corresponds to the concept of occupation;
- the concept of social structure corresponds to that of production structure;
- the description of the individual is given in terms of existential skills;
- the social status is the point of intersection between individual and society.

Certain considerations (¥) have led us to isolate two stages in the search for existential skills.

a. Individual needs and social demand

In order to identify the skills to be developed during basic training it is necessary to analyse, first, the social demand, and second (to a lesser degree), individual needs as sources of motivation.

Skills are defined on the basis of data supplied by society and the production structure, but also by the learning structure and by individuals themselves. The more accurate this data, the more closely skills will correspond to situations.

b. Relationship between social demand and individual needs

Comparison of the results of the analysis of social structures with those of the analysis of learning structures should reveal the relationship between the two and show a type of social relationship.

The production capacity of a country or production structure of any kind requires that some or all of its members should be capable of displaying particular skills. Two problems arise: that of the selection of the people eligible to learn the skills and that of their distribution, that is, the way in which they are learned.

These relationships can be expressed by the following diagram:

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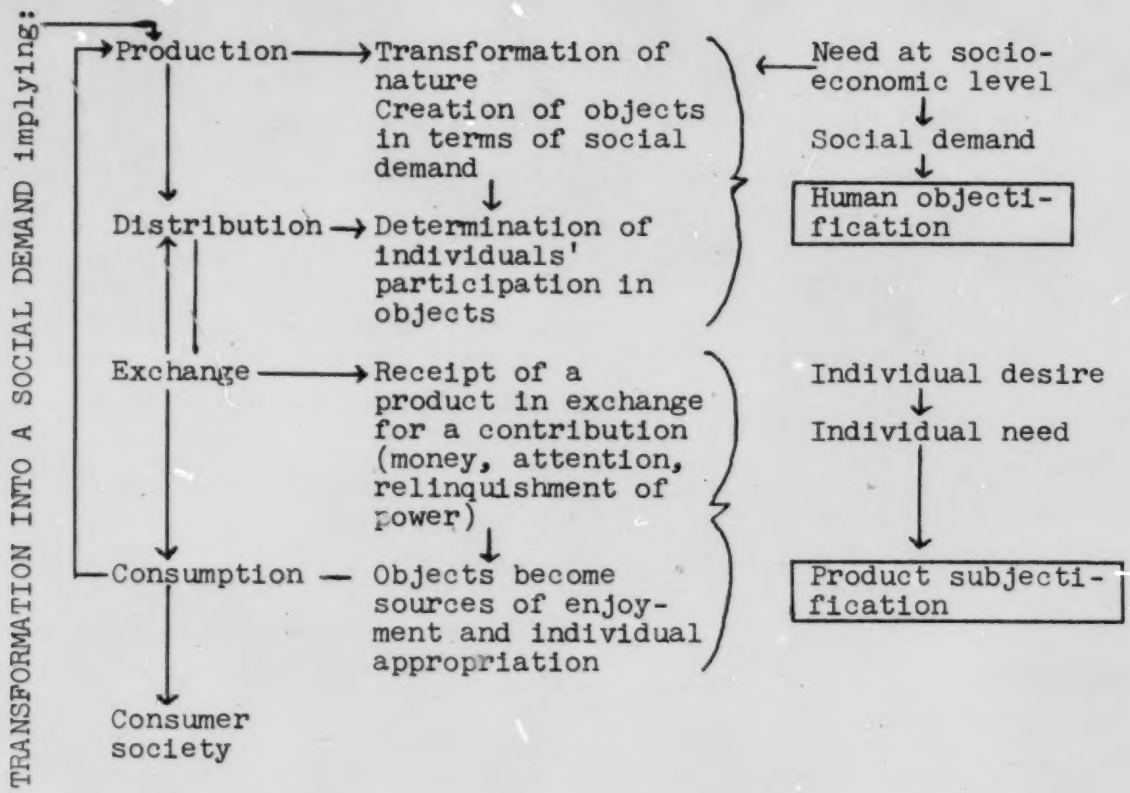
(¥) Discussed in more detail in the third publication



3. Relations between these three levels

Study of the relations between these three levels leads us to imagine a sort of matrix of influence, whose elements are in constant interaction and are situated between two extremes:

	FACTORS	
EDUCATION TRAINING	Education	political objectives: explicit - nonexistent - diverging
	Training	broad - narrow; specific - transferable; rigid - graded ...
	Recurrent attitude	eager acceptance - rejection
PERSON PRODUCER	Basic affective	attachment - detachment; isolation - contact ...
	Familial	nucleus - scattered; ethno - endo - exocentric ...
	Sociological	attraction - repulsion; interest - disinterest; participating - challenging ...

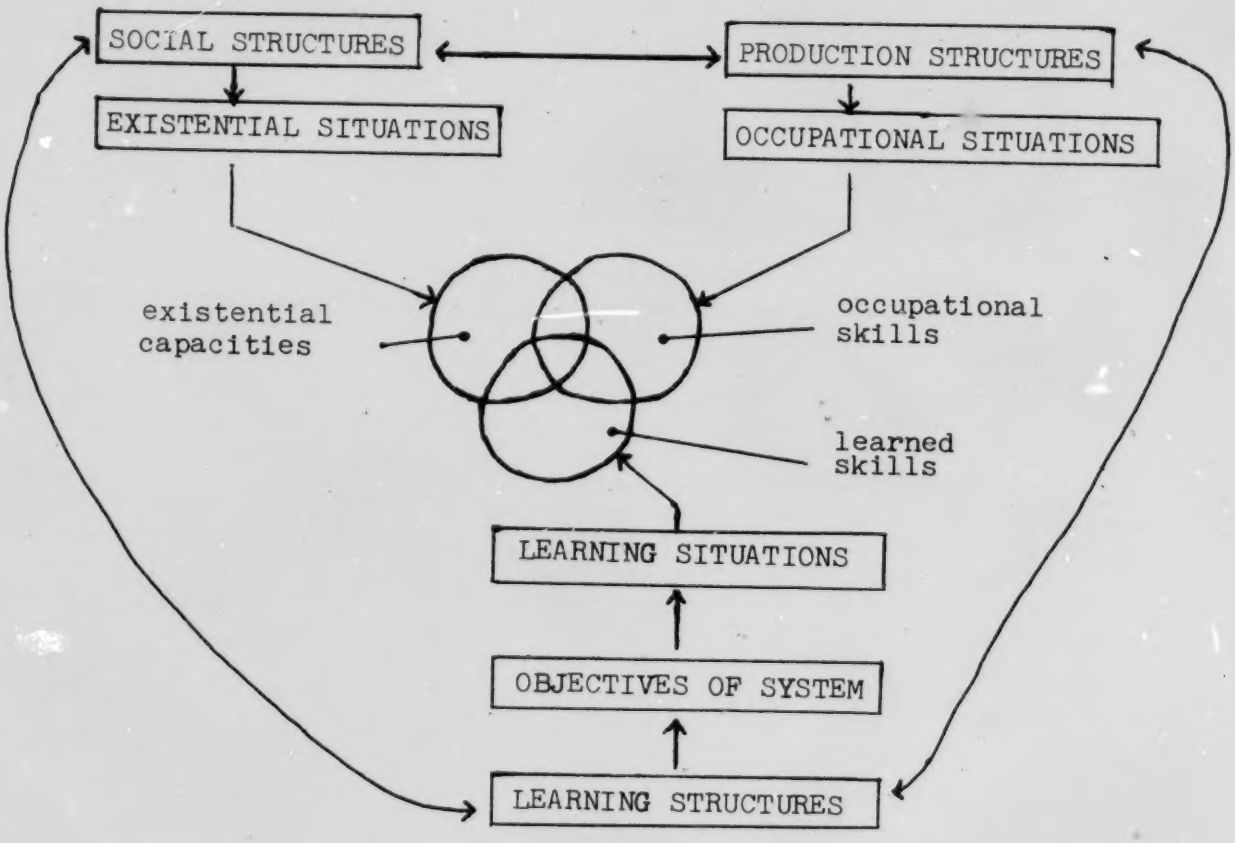
 Table continued on next page. ./.

Table continued from previous page.

	FACTORS	
SOCIETY EMPLOYMENT	Economic	expansion - recession; saturated - unsaturated market
	Structural	hierarchical - functional
	Promotional	inciting - non-inciting
	Employment policy	mobility - stability; qualification - dequalification; task regrouping - division of work

For the purposes of this analysis we shall confine ourselves to the relations between the components of the diagrams of the three structures on page 27.

a. Relations between structures, situations and skills at the three levels:



The pedagogy of learning assumes that learning objectives cover the other two sets of skills.

This is true of societies possessing strong objectives, which give great cohesiveness to the three structures.

Such conditions were found in certain micro-societies of the 19th century, in which production structures conditioned the whole of social life and learning structures were conceived with a view to the "harmonious" assimilation of the individual into the two structures.

Sometimes, all three sets of skills overlapped entirely, producing a form of continuous acculturation (from birth to death) of the values of the production micro-society (for example such industrial societies or companies as Schneider and de Wendel in France, Krupp in Germany) which stimulated, defined and assumed responsibility for the needs of individual members of such industrial concerns. Any outside intervention was regarded as disturbance.

Nowadays we may observe that on-the-job or alternating work-study training produces skills which correspond to occupational rather than social skills, whereas training at school amplifies the intersection of learned with existential skills.

b. Relations between the social being, the producer and the learner:

This is important in so far as it leads us to consider the question of training objectives.

- Which is to be trained, a social being or a producer?
- Is it possible to train both simultaneously?

To what extent the concept of permanent education considers the human being as a whole, would appear to provide an integrating force.

Permanent education means the education of a person throughout the whole of his personal, working and social life.

Permanent education covers all the situations encountered in life. It embraces all the processes in and out of school, which are designed to develop the abilities and aptitudes a person needs in order to come to terms with the life inside and around him.

Thus, permanent education reconciles the overall objectives of society with those of education, in every individual's desire to acquire knowledge and skills and to invest them, in relation to his aptitudes, in his everyday life (working, leisure, political, family).

Permanent education is the broadest concept; it includes the whole of training and animates analysis by introducing the time dimension.

There are two ways of doing this:

- according to the first, a relatively homogeneous population is considered, eg the 14-18 age-group, and their future training needs are imagined against a background of relative stability of social structures in production structures;
- according to the second, there is little projection into the future but situations are analysed in relation to a series of populations: untrained young people, semi-trained young people, adults, older people - all living in a society at the same time.

In a changing society, the second approach would appear to be preferable.

In this case, the time dimension is expressed by different ages. The object is to consider whether learning structures and everything which relates to or follows from them should be the same for all and if not, to adopt criteria for differentiating between them.

Within the limits of the restrictions imposed by society (methods, teachers, budget, resources), consideration should be given, in the methods employed to achieve objectives for the younger students, to the data of genetic psychology; for others, to antecedents, aptitudes, needs and motivations.

Data are less certain in respect of adults. Huberman (1), in a study prepared for the Council of Europe, has discussed some of the features of the psychological development of adults in the human life cycle.

If we convert the results for graphic presentation (see below) it will be observed, depending upon the placement of the educational plane along the age axis, that the objectives shadow within a set makes a greater or lesser incursion into the four sectors formed by the occupational and existential orthogonal axes.

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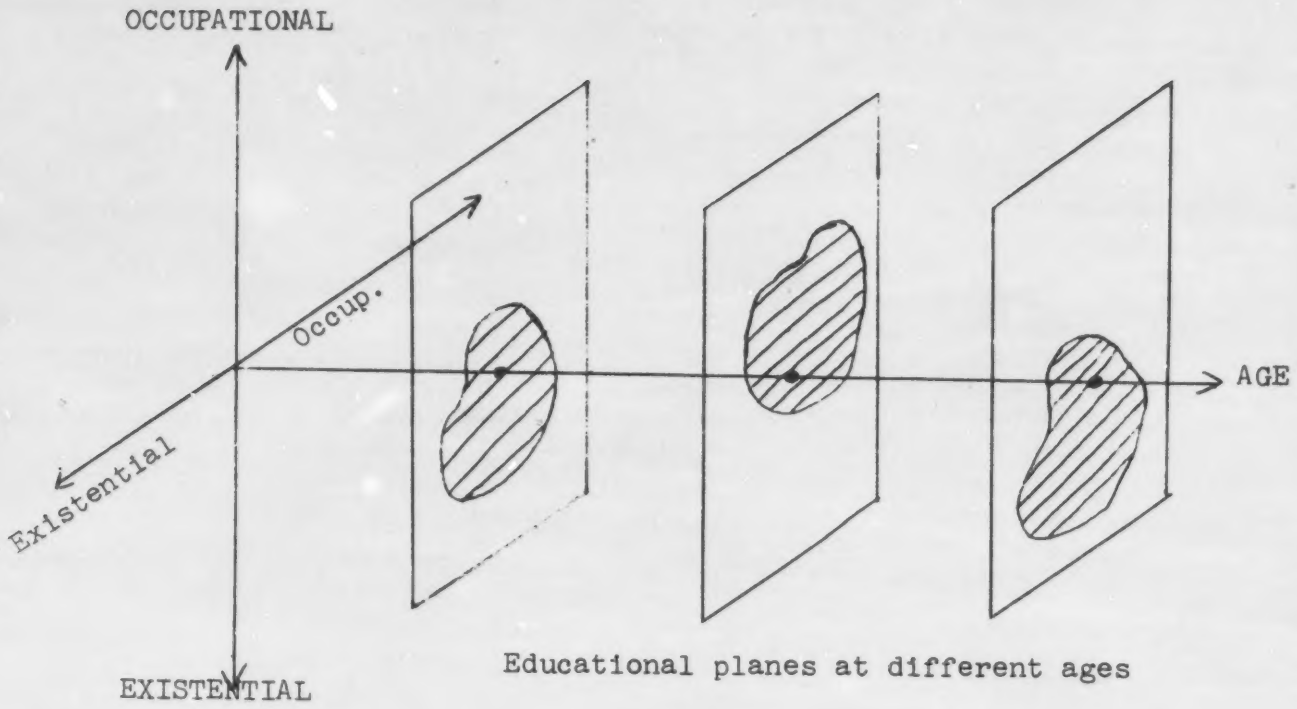
(1) Huberman (A M): Some models of adult learning and adult change, Council of Europe, Strasbourg, 1974.



Educational planes at different ages

In the middle period, for example, a man released from some portion of his family and financial responsibilities will experience a period of expansion (40-50 years of age) with a distinct recrudescence of occupational objectives. This period will be followed by a rapid shift towards "disengagement" - voluntary or imposed, in which the main objectives become those of the fight against solitude.

4. Analysis of activities and behaviours in terms of methods of objective achievement (model-building)

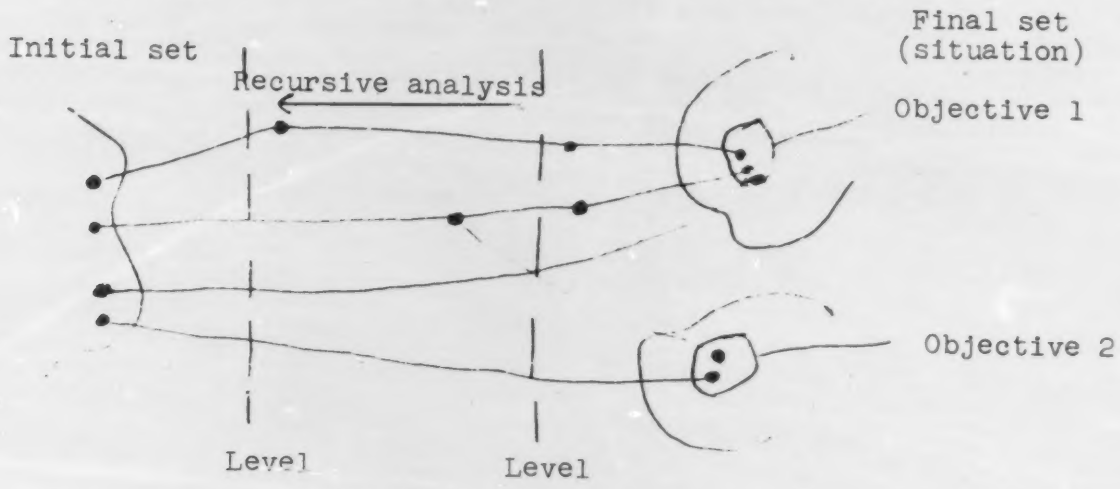
Every skill or ability to handle a situation forms an objective in the learning system.

The process consists of:

- an initial set, composed of previous learning;
- a final set, which includes the situation to be handled;
- an objective, expressed as an ability to ... followed by an action verb and a content;
- a method for achieving the objective, which conditions the subject's activity.

Between the initial and the final sets, an activity takes place, thus, determined by the chosen method.

Each situation is analysed by the behavioural analysis technique (1), starting with the activity required to meet a situation; this is broken down into subsidiary activities until the learned behaviours forming the initial set are reached.



Each intermediary point may be regarded as a sub-objective of the final objective and classified by level according to a taxonomy (*).

The aim of this analysis is twofold:

- to define the path between the two sets and evaluate the distance in terms of skills of learning individuals (role of taxonomy);
- to eliminate redundancy when the path to two different objectives (which may be contained in the same final set or in two separate ones) passes through the same sub-objectives.

The analysis of each sub-objective reveals two components, both essential to its achievement:

- the working material: knowledge, information - raw or pre-structured;
- the mental equipment: the operators used to deal with or process the working material (main concepts, methods, languages) in order to build action or knowledge models.

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(1) Lexuan, Chassain (J C): L'analyse comportemental, Nathan, Paris, 1975.

(*) See below.

All activities are supported by a system of values (attitudes) and conditioned by the potential of the subject (aptitudes).

Depending on the method of achievement favoured by the learning structure (imposition or autonomy), either the working material or the mental equipment will be fortified.

An inflexible method, for example, applied to closed situations, augments the working material of specific algorithms which can be assimilated to information.

A non-specific method, on the other hand, such as the aptitude for solving problems by working on material to be discovered, develops the subject's mental faculties in the area of empirical research.

In both cases the objective is the same but the methods employed to achieve it differ.

In practice, every situation is analysed in terms of a small number of components (eg five), and research seeks to determine which components must be cultivated to handle the situation by a definite method. If the distance between the initial and final positions is too great, the analysis must be repeated at a lower level.

The five components may be the following:

a. basic knowledge: the question is stated in terms of the knowledge content needed to learn the given behaviour.

b. key skills: those which can be employed in a broad range of situations, such as: collecting information, taking a decision, observing etc.

c. specific skills: those which are related to particular occupational and existential situations and to objects in those situations;

d. languages: to be effective in a situation, it is necessary to maintain a number of relationships with others (things and persons). This implies a command, at varying levels, of verbal, written, mathematical, symbolic, graphic etc languages.

e. attitudes: the dispositions (intersection of cognitive and affective) expressing the subject's investment in relation to situations.

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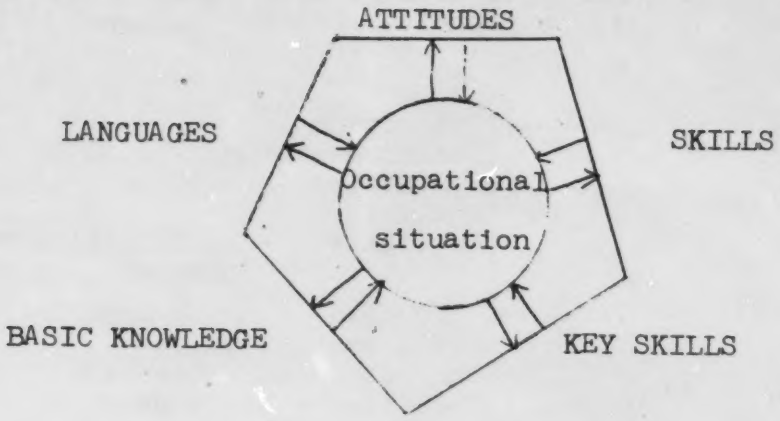


Each occupational situation is analysed in terms of this diagram. Knowledge, key qualifications, languages, specific skills and occupational attitudes are grouped together. Overlapping is eliminated. This produces a directional graph.

This method combines both definitions of sets: definition in relation to a frame of reference (analysis of production relations) and construction, by recursive methods, of a graph structure of learning.

Each of the skills singled out is defined as:

- the learner is capable of ... followed by a verb and a content (educational objective);
- the level of attainment of the objective. At this point the taxonomies of Bloom, Krathwohl and Harrow may be used.

cognitive	affective	psychomotor
Evaluation	Characterisation by a value or system of values	Non-verbal communication
Synthesis	Organisation	Physical abilities
Analysis	Degree of value attached	Perceptive aptitudes
Application	Response	Basic fundamental movements
Understanding	Reception	Reflexes
Knowledge		

Alongside these taxonomies we suggest a structure in levels, as being more appropriate to technical and occupational education (1):

Problem-solving	Evaluation Decision-making Synthesis Analysis Application - assimilation of movement
Learning of knowledge, skills and attitudes	Attachment of value Understanding - Accuracy Imitation - Response Sensation - Reception

- Conditions in which the skill is expressed (in school, on the job etc)
- Initial level required to learn this skill (prerequisite)
- Final level, which is a synthesis of the preceding aspects.

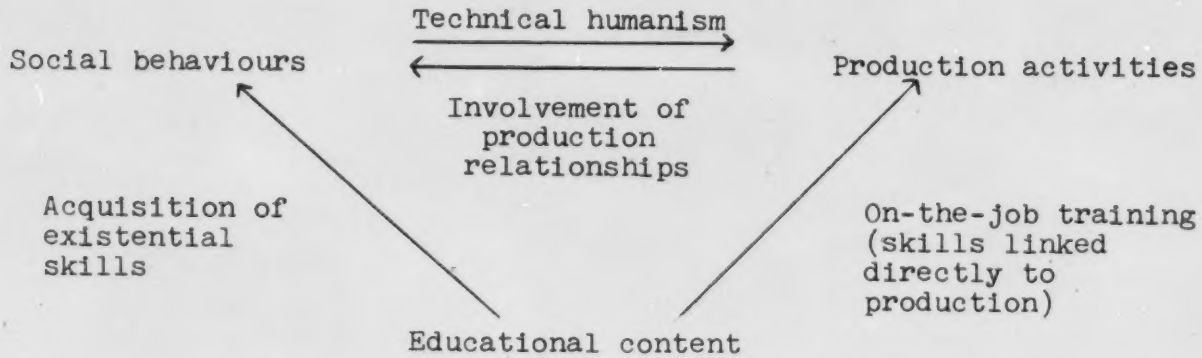
This produces a body of skills structured by the systematic analysis which has been our guide.

Only after this considerable analytic effort has been made is it possible to build an educational system based on methods for achieving objectives which can give students complete command over skills.

3. Conclusions

The definition of skills and educational objectives is the outcome of a process of analysis. The curriculum must restore the overall dimension of functions and production relationships.

At this level, thus, we return to the relationships between social behaviours, production activities and educational contents - the latter being meaningful only in relation to the first two - which have still to be clarified.



(1) Chancerel (J L): Les objectifs pédagogiques, Cahiers de psychologie et de pédagogie, Neuchâtel, 1977.

Occupational training must not be confined to the learning of abstract occupational motions, and the frame of reference must be broad enough to allow for unlimited flexibility and occupational mobility of the trainee.

Basic occupational training should accordingly be centred upon basic knowledge, key and language qualifications; the other two dimensions - specific skills and occupational attitudes - are covered in subsequent years, the former because they pertain to specialisation and thus to a restriction of the field of possibility, and the latter because they are the results of response to a praxis.

III. THE ROLE OF WORK SYSTEMS ANALYSIS IN THE DETERMINATION OF OCCUPATIONAL SKILLS TO BE DEVELOPED IN EDUCATION AND TRAINING (*)

F Lantier

1. Some aspects of trends in work

What is the role of work systems analysis in the development of vocational education and training? Can it still be thought of as an unjustified interference by the working world in the domain of culture and knowledge, which pursues its own course in academic repose above any shadow of suspicion? Does this kind of analysis really duplicate information and concepts which are already at the educator's disposal? And once it is agreed that work systems analysis may be allowed to exist, is it, as some say, a strait-jacket into which training is being forced, robbing the educator of all initiative in the choice of his material and methods, allowing him only the narrowest of aims and compelling him to dole out a sort of cut-rate training and to supply employers with young workers who have been badly taught, though they may be immediately employable?

These questions impede the dialogue between work analysts and educators and add to fears that training may come to play second fiddle to employment, to its own detriment.

The search for methods of work analysis which would be meaningful to educators has resulted in technical solutions differing with the country and school. Looking beyond these differences, however, some clarification of the way in which these methods hope to help the educator in his work would seem essential.

We shall accordingly try to explain the basic assumptions underlying an approach whose main aim is to enable course designers to integrate the various aspects of today's technical and social developments into their training programmes. The object is to promote the development of technical education for pupils about to embark on their working life, while at the same time offering trainers an approach which will facilitate their assimilation of new data and prepare them to confront their new responsibilities, for education by objectives offers teachers greater autonomy than do traditional programmes, which are sometimes more productive of routine than of a search for original solutions.

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(*) Statement made by Françoise Lantier to the Group of Experts on Basic Occupational Training (Council of Europe) to be published in Le Travail Humain (No. 2/1977).

Over the last fifteen years, work analysis and teaching have each developed according to its own rationale, though not without points of convergence, as in ergonomics. While training has generally centred on the techniques of a trade, work systems analysis has come to explore other dimensions of work situations, less familiar to teachers. It has now made sufficient progress in that direction to suggest that the educator integrate the new dimensions in his course design. The findings of work systems analysis are now solidly supported by certain internationally known basic research projects and also by systematic surveys carried out in industry in several countries. CEREQ, for example, has for some years been conducting a series of surveys using complementary methods suited to specific objectives (ǂ).

We shall look at the contributions made by work systems analysis in industrialised countries, concentrating less on phases - for all of this research was convergent - than on the facets brought to light by different approaches corresponding to different preoccupations.

1.1 Work analysis

1.1.1 The original research of Alain Touraine (France (1)), which concentrated on the effects of technical changes in the car industry, and that by Naville (France (2)) on the automation of manufacturing processes, established that an estrangement had grown up between man and technical processes. Their analysis showed that the automation of production processes had separated man from the manufacturing act and changed the nature of his intervention in an increasingly integrated technical system. These general conclusions have been interpreted very narrowly, however, and have served only to reassure the type of industrial organisation known as "scientific management", which shifts all the work of conception and preparation to the top levels of the manufacturing process, leaving only fragmented operative jobs for the workers to perform.

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(1) Touraine, (Alain): "l'Evolution professionnelle de l'entreprise", in Traité de Sociologie du travail, Armand Colin, 1962, Vol. 1.

(2) Naville, (Pierre): "Division du travail et automation", in Vers l'automatisme social? Gallimard, Paris, 1963.

(ǂ) The main work systems analysis research carried out by CEREQ includes the following:

a. sector-by-sector studies (as a contribution of the Employment and Forecasting Department to improved employment forecasting);

b. the "Répertoire Français des Emplois" (systematic employment data, by the Occupational Qualifications Department);

c. work systems analysis (a contribution to the determination of occupational skills to be developed in instruction, by the "Mission pédagogique").

1.1.2 Another line of research, contemporary with the above, has been fundamental to the understanding of human labour in an industrial setting. I refer to the research carried out by a group from the Tavistock Institute for Human Relations (United Kingdom), the most often quoted members of which are Trist (1) and Emery (2). By making a close analysis of trends in work in colleries which were in the process of being mechanised, the authors found that there was a social element in work done by crews performing jobs which were complementary but highly inter-dependent. The Tavistock research showed that it was no longer possible to reduce the description of a job to a relationship between a man and a technical process and, by introducing the concept of a socio-technical system, they brought out the role of communication within groups of workers. Of course, these findings supported the theories of human relations and helped to win wide acceptance for them. It will be noted, however, that scientific management and human relations theories have been applied con-currently by specialists with different training - by engineers and sociologists, for instance - working independently in different departments of a firm, so that the function of human relations became, in a sense, to offset what were regarded as the unavoidable disadvantages of task specialisation.

1.1.3 The scientific follow-up to the Tavistock Institute's work took quite a different direction with Thorsrud (Norway (1)) and Emery, who understood not only the new opportunities for human labour opened up by this estrangement of man from the technical process, but also how difficult it was to replace a system of work which was rigidly hierarchical and compartmentalised by a model based on flexible rules. The authors looked for ways of introducing change in a firm, and, combining conceptual rigour with the imperatives of action, they proposed new models for the organisation of work combined with new methods of working, in which techniques, far from being a panacea, served rather as a foundation for a process of collective change. Thus was born a new theory of working life based on a novel operational method, still not very widespread outside northern Europe, which is known as "organisation development" (OD).

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(1) Trist (E), Higgin (G W), Murrary (H), Pollock (A B): Organisational choice, Tavistock Publications, 1963.

(2) Emery (Fred): "Characteristics of socio-technical systems", in Davis L E and Taylor J C, Design of Jobs, Penguin Books, 1972.

(3) Thorsrud (Einar): Industrial organisation: theory and practice, Oxford University Press, 1965.

1.1.4 At the same time, researchers from the major Anglo-Saxon management schools have been finding, with Joan Woodward (United Kingdom) (1), the limitations of traditional theories of industrial organisation, which are by no means followed universally and which, when they are applied, often prove not to serve the firms' purposes at all. Like Lawrence and Lorsch (2) and Perrow (3) in the United States, Woodward has concluded that scientific management was a failure and prepared the ground for a completely different approach to human work in industry.

1.1.5 The systematic surveys which have been carried out by CEREQ in the last five years in no way contradict the findings of these researchers, but show that for similar technical processes, there may be enormous variety in employment structures and task allocation (x). This clearly means that other factors predominate in the exploitation of technical training.

The changing concept of work organisation, of which we have just traced a few of the many facets, is no longer the preserve of a small number of researchers or specialists; the subject is now taught in management schools. What is our educational systems' attitude to this development, which is now generally acknowledged and irreversible?

Most educational systems seem to have interpreted the estrangement between man and the technical object in accordance with scientific management ie by taking for granted the separation between planning and operative jobs.

Thus, while still focussed on the construction of a technical object, vocational education has become much more abstract, to the detriment of concrete teaching, and the technical object has been transformed into an intellectual object defined by its parameters and losing, in a sense, its usefulness. As far as

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(1) Woodward (Joan): Industrial organisation: theory and practice, Oxford University Press, 1965

(2) Lawrence (Paul R) and Lorsch, Jay (W): Adapter les structures de l'Enterprise. Les éditions d'organisation, Paris, 1973. Original edition, Harvard University Press, 1967.

(3) Perrow (C): Organisational analysis: a sociological view, Tavistock Publications, 1971.

(x) These findings converge with the hypotheses which led the Institut für Arbeitsmarkt- und Berufsforschung (Federal Republic of Germany) to undertake systematic research on occupational families and substitutable jobs (cf. D Mertens: Key qualifications in basic and further education (CCC/EES (72) 10)) and caused the Training Services Agency (United Kingdom) to investigate groups of skills (cf. Grouping of Skills, London 1975).

The organisation development approach may be studied in the group project "L'organisation du travail et ses formes nouvelles" published in the series "Bibliothèque du CEREQ"; see also, in the same series, A Chenu's book "L'accès aux emplois industriels - Fos - Etang de Berre - Marseille".

operative jobs are concerned, it seems to be assumed that they have no place in any system of education and that the "contact" course lasting a few days or weeks is enough to train the people who have been overlooked by recent industrial developments, ie the specialised workers and operatives of every kind.

As we have tried to show, industrial work situations have moved away from the construction of the technical object, but educational systems have not really made allowance for this change. The estrangement between man and the technical object has at least three consequences which merit consideration by the educator:

- in work situations, the manufacturing act is no longer dominant in the relationship with the technical object;
- manufacturing is no longer the product of an individual's effort, but the result of teamwork;
- in itself, the technical object or system is no longer the object of work.

Thus a sophisticated education based solely on the making of the technical object does not correspond to modern trends in work, and the training of workers cannot be confined to learning how to manufacture an object without reference to its industrial context. In any industrial situation, a technical object is just one parameter among many, in a social and technical system actuated by conflicting rationales but never by the sole one of construction.

For example, during a recent survey of work on automated systems, researchers noted that very few technicians used Karnaugh's diagrams even among those who knew them, although these diagrams were derived directly from combinatorial analysis and would have enabled them to find the best technical solution using only a few parameters. In fact, when faced with a technical problem a worker or technician can seldom apply the optimum solution but must work out a practical compromise among all possible solutions. In an industrial context, the requirements for technical optimisation are never met; similarly, parameters are not neutral and not equally likely to be taken into consideration (*). Every technical solution is primarily determined by a body of priorities and imperatives which compel the worker and technician to restructure their theoretical knowledge in response to parameters of which they are not even aware: cost, deadlines, availability of supplies, workload plans, sub-contracting practices, availability of staff, customers' desires, the conditions in which work has been carried out at previous stages of production, the relation between one worker's department and other departments (purchasing, sales, personnel, accounts) and, of course, the firm's production policy.

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(*) These remarks are not meant to challenge the instructiveness of Karnaugh's diagrams or any other theoretical model; such models are essential to the learning situation.

In the end, the worker must invent some empirical means of organising what he has learnt previously, following a logic of experience which he has to create for himself. In other words, he must gradually build up his own reference system in the course of his practice - that is, a system composed according to laws derived from the system itself (*) as he sees it.

This has been demonstrated remarkably well by two ergonomists. At the end of a piece of original research designed to produce a training scheme for air-traffic controllers at Orly, A BISSERET and Cl. ENARD (France (1) observe:

"While the sets of memory-stored data which constitute a 'trade' possess their own laws of construction or operation independent of their specific application to work, they are in fact restructured on-the-job by an experienced worker, in relation to the purpose of the system ..."

Distinguishing between two main types of work unit: (a) categories of data possessing an internal logic independent of the functioning of the system or operator, or a logical construction; and (b) the processes or method of treatment actually used by an experienced operator to obtain a precise result following a logic of utilisation, the writers conclude that "job analysis must describe categories of data and processes precisely, by reference to their logic of utilisation".

This brings us to the very heart of the problem. Does technological teaching centred on the manufacturing act and following a logic of construction prepare the worker or technician to master a job which we now know operates according to a process governed by other types of logic which are not taught?

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(*) See Jean PIAGET: "in the subject's activities structures exist in two senses: (1) as wholes composed according to laws belonging to the system itself and (2) as systems likely to arise in the same forms irrespective of differences in their contents." In "Epistémologie mathématique et psychologie - essai sur les relations entre la logique formelle et la pensée réelle," Vol XIV of l'Epistémologie génétique (page 182), quoted by JB GRIZE.

(1) BISSERET (A) and ENARD (Cl): "Le problème de la structuration de l'apprentissage d'un travail complexe". Bulletin de psychologie, XXIII, Nos 11-12, 1969-1970.

2. Methods used to define training objectives

The problem of adapting training to the job has long preoccupied the United States, Europe and the developing countries. It has been unendingly debated at the theoretical level, and the educational aspects of this debate will be considered in an AFPA publication (*). Here we shall confine ourselves to a brief review of the most characteristic methodological projects, in order to relate our work to them.

Initially, a distinction must be drawn between:

1. the methods which have followed the shortest route between employment and training, without analysing the work actually done;

2. the methods based on work system analysis.

1. The direct methods fall into two groups:

a. those based on job profiles;

b. those based on training profiles.

a. The first group have in most cases been developed to meet specific, urgent needs in situations where there was a critical shortage of skilled labour, and it is to them that the criticism mentioned in the introduction applies most forcefully. One example is the employment qualification modules worked out by the International Labour Office Training Department (1976) (**) designed to introduce accelerated training schemes in developing countries or regions.

According to this method, a diagnosis of the needs in basic specialisations is made after consulting various qualified and responsible persons. Then, starting from pre-determined job profiles, training modules are worked out following a principle of economy: bridging the gap between learned skills and jobs, avoiding the wastage inherent in many training programmes, limiting their duration, and stimulating the desire to learn. This method establishes a direct relationship between job profile and training, retaining only the part of training course content which can be observed in standard use. It thus has no long-term objective (***).

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(*) AFPA: Formation initiale des techniciens au automatique (December 1977).

(**) ILO, Vocational training and job qualification modules, Training Department, February-March 1977.

(***) Experience shows that semi-skilled workers are those worst hit by unemployment in the event of recession or industrial reorganisations. See LANTIER Françoise, "Automatisation, emploi et formation - Réflexions sur l'expérience des Etats-Unis," CERP Bulletin 12, No. 1, 1963.

b. The second group of methods devised either by educators or for them, by specialists in educational sciences, is aimed at improving the effectiveness of learning. These methods, which are based on theoretical models of the psychology of intelligence and distinguish between cognitive, emotional and sensorimotor objectives, have given rise to many taxonomies of educational objectives (see B BLOOM, United States) (*)and to constructions which may vary in sophistication but are conceptually loose, in so far as they do not differentiate between mental and behavioural objectives. For example, lists of objectives have been submitted to engineers but there has been no analysis of their actual work (see V and G LANDSHEERE, Belgium). As these methods are based on general theoretical objectives such as the development of intelligence, without reference to the way in which knowledge is actually used, they fail to meet or provide satisfactory solutions to the problem of the aims of education. If researchers confine themselves to considerations of educational psychology, without looking at the technical and social transformations of the environment, and if they produce formal models which are given as representing real systems, they may simply bolster such sophisms as "the more general an education, the better suited it will be to meet specific situations".

2. HEYWOOD and his team in the University of Lancaster (United Kingdom) have understood the limitations of an approach which defines training objectives without reference to the work actually performed by the people affected, and chose to look at the question of training objectives by means of methods based on work. After lengthy interviews with 39 engineers in an electro-mechanical firm, the researchers drew up highly detailed lists of tasks and, after simplifying them, checked their validity with 200 engineers in the same firm. Factorial analysis then enabled them to reduce a list of 500 items to 14 "skills", each of which covered a body of scaled tasks representative of the engineers' work in this firm.

The method is interesting in that it is based on work actually done by engineers and attempts to look at the job as a whole instead of merely at the intellectual abilities mobilised in work situations.

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(*) BLOOM (B) et al.: The taxonomy of educational objectives, Vol. 1, Longmans Green, 1964. LANDSHEERE (G) and (V) de: Définir les objectifs de l'éducation, Paris, PUF, 1975. HEYWOOD (J), YOUNGMAN (M B), MONK (JD), OXTOBY (R): Summary and results of an investigation into the classification of objectives for the training of technologists and technicians, Final report No. 1, Department of Educational Research, University of Lancaster, polycopy 1973.

Its limitations arise from the fact that HEYWOOD did not investigate the socio-technical structure in which the engineers were performing their tasks, for that structure was supplied by the particular organisation of the firm in which the survey was conducted. In any investigation involving more than 1 firm, the problem of the division of tasks arises, together with that of the boundaries of intervention of the different occupational categories. As these vary from one firm to another, a catalogue of tasks established in terms of a single firm cannot be taken as representative of the skills required in a given occupational category. If an investigation is to have wider relevance, it cannot be confined to a catalogue of work units in terms of tasks or operations which are completely independent from one another. Instead, a system of reference must be devised which will allow for the diversity of task division in different firms and define the inter-relationships between tasks, more clearly in terms of the system of reference.

One final point calls for comment. What use has the educator made of skills built up from behavioural objectives? Such objectives, or practical skills and abilities, are only one component of engineer training. It is hard to see how a basic training course can dispense with fundamental knowledge which may not be perceptible at the level of tasks and operations in the working situation.

3. One means of determining the occupational skills which need to be developed in training courses has been devised jointly by CEREQ and AFPA (*); it applies to automated work systems.

The object was to enable course designers to refer to a meaningful system of reference when defining training objectives - one which would allow for the diversity of work situations. As well as providing a useful instrument of reference for joint labour/management committees, the analysis was to be amenable to systematic application by groups of educators seeking to revise courses in that particular field and related areas of specialisation.

The project took place in two phases, namely:

1. work systems analysis

2. definition of training objectives to be included in course programmes.

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(*) See CEREQ - AFPA: Le travail sur systèmes asservis - January 1976. Study carried out by a team of CEREQ engineers in co-operation with instructors from the AFPA training centre.

The following paragraphs concern only the first phase, which was directed by CEREQ with the help of AFPA educators.

For CEREQ, the object was to create a method of work systems analysis which would provide the fullest possible account of both the way in which existing training courses were used and the processes of human intervention in automated work systems. This implied finding a means of verifying the specific conditions in which training was applied in particular work situations.

The first difficulty arose from the impossibility of establishing a correspondence between the concept of automation (or the concept of servo-systems which was used in the investigating stage) and a particular type of firm, in terms eg of sector of activity or function in production (maker or user). Automation could affect most production processes, and so the field of automation was indeterminate and constantly changing.

A second difficulty was caused by the fact that job and training were twice removed, which meant that there could be no direct transfer from one to the other. The first remove occurred in the organisation of work within firms: the practices followed in the utilisation of the work force were so heterogeneous that no particular organisation could be regarded as a satisfactory mediator for the educator. The work situation found in one firm did not refer to the whole of the educational system but rather to specific training courses corresponding to that firm's particular needs. The second remove resulted from transformations in the system of division of labour between firms, including the deconcentration of means of production and the formation of networks of associated firms connected by sub-contracting or co-contracting relationships. A firm seen independently of its network could not be regarded as a satisfactory mediator for the educator, and supplied the educational system with very partial data regarding the application of vocational training courses.

If educational systems are to devise training objectives which will remain valid regardless of the specific forms of work encountered on the job, they must nevertheless dispose of a system of reference which reflects the characteristics of the work system as a whole.

For this reason, rather than following an unproductive statistical approach or undertaking specific case studies, the project sought to cover the entire field of human interventions which could be perceived at that time, within limits determined by a suitable methodology.

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3.1 Methodology

3.1.1 The solution adopted entailed the definition of a cross-firm axis, or processing axis for automated systems, including the major phases of planning, manufacture, installation, maintenance and repair (*). The advantage of this method is that it makes allowance for the division of labour within a group of firms and locates each firm observed at a point on the axis, according as it is responsible for all or part of one or more phases.

In order to cover as much as possible of the field of human interventions which can actually be seen on the chosen axis, a representative sample of about twenty firms was selected on the basis of two criteria of diversity: sector of activity and phase in the processing system (**).

3.1.2 Once the observation axis was defined it became possible in each firm to situate the work subsystem generated by one and/or another of the processing phases for automated systems. The work system covers all the jobs concerned, whatever their description, position in the hierarchy of the field of specialisation of the persons performing them. These jobs are regarded as being the foundation of the system.

3.1.3 Starting from information supplied by persons belonging to the system, relating to both the use made of their training and the nature of their intervention within the system, a search was made for common units of analysis; these were obtained by dividing the phases of the processing axis into sequences of human intervention (***) which are the smallest units of analysis shared by all the systems observed.

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(*) HATHOUT (A) and LANTIER (F): Analyse du travail dur systèmes asservis, Méthodologie et traitment des données (CEREQ publication, December 1977).

(**) The number of firms observed depends upon the saturation of the field in "interventions", which means that the survey can be stopped whenever it is thought that additional observations would have no effect upon the field of interventions (their frequency being irrelevant in this context). Leaving aside the fact that the field of interventions may subsequently be deformed, the frame of reference composed in this way may be regarded as providing a closely representative model of the automated work system, for equivalent technological systems and irrespective of the type of division of labour and task allocation.

(***) See appended list of sequences of human intervention identified in the automated work system.

3.1.4 After the content of each sequence was analysed, the entire group of sequences of human intervention was re-analysed in terms of corresponding elements. The object of this was to study the distribution of sequences in terms of both the individual characteristics of the persons interviewed and the type of "making" or "using" firm.

The results of this study have supplied educators with an exhaustive analysis of types of intervention in automated work systems and also with some general conclusions, chief among which are the following:

a. Specialisation of intervention was found in very few firms, whether in planning or maintenance. The area of intervention of employees working in an automated system is very wide as a rule, and those interviewed were involved in at least two and usually three or more phases of the system.

b. An automated system does not coincide with a particular field of specialisation, as several technologies are involved in the different operations and the majority of those interviewed use at least two and sometimes three or four of the following technologies: electric, electronic, mechanical, hydraulic, pneumatic and computer sciences.

c. In nearly nine out of ten instances the basic training of employees working in these systems falls into one of three levels, in the following proportions: V (professional worker), more than one out of three; IV (technician), one out of four; III (advanced technician), one out of four. These levels are associated with the initial field of specialisation (*).

d. A permanent education profile is shown by staff working with automated systems: more than eight out of every ten persons have taken part in at least one training project since beginning work (**).

e. By analysis of sequences of human intervention it was possible to verify the accuracy of both the processing axis used in identifying interventions in automated systems and the classification of the sequences.

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(*) Level of advanced training at V: mechanics (.57), electrotechnology (.52) and electronics (.73). Level of advanced training at IV: mechanics (.07), electrotechnology (.26), electronics (.58).

(**) 414 instances of training were mentioned; of these 44 were in progress or had not yet begun whereas the 370 completed training courses were divided among 116 people and were of the following main types: courses arranged by manufacturers (40%), courses in automation, electrotechnology or electronics (37%), general courses (12%).

f. Analysis of these sequences in relation to different variables indicated that discriminations were made for more in response to the characteristics of the firm than to those of individual training.

Sequences may be broken down into three types of intervention:

- sequences of planning and manufacture, which may be regarded as the engineering or architectural function of the system. This function is more particularly but not exclusively characteristic of interventions of the sub-group at level III and very distinctly characteristic of firms of the "builder" type.

- the servicing and repair sequences form the maintenance function in the system. This function is more particularly but not exclusively characteristic of the interventions of both the level IV sub-group and the level V sub-group (the two being in this sense equivalent), and very highly characteristic of firms of the "user" type.

- installation sequences form the installation function of the system, which is always associated with one of the other two; it is common to all sub-groups and characteristic of none in particular.

The types of intervention required of people working on automated systems are ultimately determined far more by the organisation in which they are employed than by their level of training and initial field of specialisation. Whatever the theoretical objectives and particular techniques used by the educator, therefore, he must not neglect the range of interventions identified by work systems analysis.

On the second phase, the results of the study were processed for application for training purposes. This was done by a group of educators from AFPA training centres, in the Centre pédagogique et technique régional at Istres, which is responsible for AFPA automation training throughout the country (*). The group was instructed to devise training objectives incorporating the results of the work systems analysis, preparatory to setting up an initial training programme. While respecting the process of training itself, and starting from the basic theoretical and technical knowledge relevant to automation, a training scheme is designed incorporating the cultivation of the competences required for intervention in the work system.

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(*) See GIRARD (J): Etude d'un programme de formation professionnelle initiale de techniciens sur systèmes automatisés, to be published in Le Travail Human (No. 2/1977).

It should be noted that the task of the educators responsible for designing a training programme involves more than the mere transposition into educational terms of the model supplied by the analysts. Just as the analysts had to create a sociotechnical construct to account for human interventions in automated systems, so the educators must produce an educational construct as a basis for a training programme. This construct is a synthesis of the "notional units" relating to the knowledge of technical objects, and the "training objectives" derived from analysis of interventions affecting technical objects. The implementation of this programme introduces an "educational option", in this instance "learning by means of concrete problems relating to a practical technical theme", whose purpose is to enable trainees to improve their ability to command the resources they need to solve a problem.

Lastly, the programme designed by the educators does not enclose teaching within some standardised practice. The trainers, like the analysts and educators, will have to produce a construct too, in this instance a teaching situation. On the basis of the programme presented to them, they must redefine their "operational educational objectives" and select the technical themes and methods which will serve as the medium for their relationship with their class.

The results of this experimental study must be interpreted in the light of the general hypothesis which we have outlined. It has borne out the idea that the individual manufacturing act does not exist in this form of work system. The hypotheses regarding the transformation of human work as a result of automation which concluded that a "Taylorised" separation would take place between planning and the carrying out of plans, must be restated in very different terms. The gap between planning and performance becomes meaningless in an automated system. There is a distinction, not really a gap, but it is rather between the engineering and architectural functions of the system and its maintenance function, with the installation function acting as a hinge between the two. The basic training given to production agents should be refocussed on the installation and maintenance functions and should incorporate elements relating to the components of a socio-technical system, its mode of operation, and the way in which humans intervene in such systems, so as to ensure the coherent development of the underlying skills and theoretical and technical knowledge.

An approach of this type could be applied to a great many industrial systems in which operatives empirically perform complex work which, because it has not been identified by works systems analysis, is still regarded as unskilled.

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The incorporation of this new data into vocational training policies, which have hitherto been conceived in relation to scientific management, will create very acute problems in the immediate future for those responsible for technical and vocational training in the industrialised countries of Europe. In view of the sluggishness with which educational systems respond, it would seem essential to face them now.

LIST OF SEQUENCES OF HUMAN INTERVENTION IDENTIFIED IN AUTOMATED WORK SYSTEMS (*)

PLANNING

1. Specifications/contract
2. Block diagram
3. Choice of base materials
4. Time diagram
5. Principle circuit
6. Choice of secondary components
7. Expanded circuit and installation circuit

MANUFACTURE

1. Setting up of material
2. Wiring of internal connections
3. Manufacturing trials

INSTALLATION

1. Setting up or mechanical adaptation
2. Connection
3. Verification of functions and organs
4. Switching on
5. Testing and adjustment
6. Circuit revision
7. Preparation of instructions for adjustment, use, repair and maintenance

SERVICING

1. Preparation
2. Servicing

REPAIR

1. Preparation - analysis of breakdown symptoms
2. Circuit study
3. Verification of external elements
4. Verification of monitoring and control
5. Repair

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(*) See CEREQ-AFPA, 1976.

IV. THE CONCEPT OF OCCUPATIONAL FAMILIES IN RELATION TO OCCUPATIONAL TRAINING - AIMS, IMPLICATIONS, METHODS AND CONTENTS

M Kaiser and H Werner

1. Purpose and aims of an occupational basic training

Economic growth incorporates economic change and economic change alters the conditions of economic and occupational activity. These vary in trend and pattern and call for new skill requirements from the persons in the labour force due to:

. The technological element of structural change

Technological processes are getting more and more sophisticated. New basic materials are being introduced, new means of production are being developed and needs for more "developed" goods are being raised. As a consequence new jobs are emerging which require, on the one hand, higher skills and, on the other, - due to automation - less qualifications.

. The organisational element of structural change

With the increase in the size of firms, work has to be better organised. A greater division of labour becomes necessary, problems of communication increase and entail new forms of adjustment.

. The economic element of structural change

Competition requires efficiency orientation. Streamlining of production leads to a changing mix of factor inputs: firstly, it leads to a substitution of human capital by real capital: in other words, men are replaced by machines. Secondly, low productivity jobs are exchanged with higher productivity jobs. In the wake of the technological, organisational and socio-economic progress, discrepancies arise between job requirements and workers' skills. Four sometimes contradictory theories can be discerned.

. Deskilling theory

Increased automation (eg assembly line) and mechanisation of the traditional occupational activities, the introduction of new means of production, production methods and new products as well as the consequential reorganisation of the manufacturing process lead to more less-skilled jobs. Existing skills become redundant or devalued and are no longer in demand, eg in transport, storing, filing (1).

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(1) BLAUNER, R: Alienation and Freedom: The factory worker and his industry, Chicago/London, 1967 (p. 166)

. Upskilling theory

This is the opposite hypothesis to the previous one: increased automation creates new activities (eg planning, communication, controlling, research) requiring the utmost precision, responsibility and reliability. This is particularly the case in industries producing highly sophisticated apparatuses with considerable research development and control needs (1).

. Polarisation theory

This is a mixture of the two previous hypotheses: technological, organisational and socio-economic progress entails higher skilled jobs, on one side, and lower skilled jobs, on the other (repetitive manual work, simple machine control operations, etc). The polarisation of job skills corresponds with a polarisation of the qualification requirements for the work-force.

. New-skill theory

With increased technological, organisational and socio-economic progress, specific skill and job requirements are being abolished. However, the resulting vacuum is compensated for by new skill requirements: the worker has to acquire additional skills of the same, lower or higher level compared to the previous ones.

As a result, we can start from the fact that occupational training should be accomplished in broad occupational categories, enabling and facilitating further specialisation or later occupational change. The apprentice should not be trained in only one specific job. Training which is not too specialised, together with a theoretical base, should guarantee job security and maintain status and income for the worker and place him in a position to cope with changes in occupational requirements. Training for a broad range of occupational opportunities, for sets of interrelated occupations which require a similar training pattern - in other words - according to occupational families (occupational clusters, occupational lines) should attain these goals. Such a polyvalent training should aim at:

. enabling and facilitating a subsequent occupational change within the same occupational or training family,

. enabling the worker to perform several activities related with each other,

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(1) BRIGHT, J R: Lohnfindung an modernen Arbeitsplätzen in den USA. in: Automation und technischer Fortschritt in Deutschland und in den USA. Ausgewählte Beiträge zu einer internationalen Arbeitstagung der Industriegewerkschaft Metall für die Bundesrepublik Deutschland, Frankfurt am Main 1963 (pp 133 - 193).

- making it possible, with the help of the basic training, to specialise in a range of occupational activities,
- facilitating the attainment of more and higher skills,
- giving the possibility to change, at a later date, the occupational and educational decision taken,
- enabling the worker to cope with occupational changes.

2. Traditional classifications and their use in a system of occupational basic training

For the construction of a system of occupational basic training which fulfils the above-mentioned aims, we have to know what occupational pattern prevailed in the past, and what structure is to be expected in the future. Training along occupational lines requires knowledge about those occupation groups which require the same basic training.

In order to achieve this, we must compare the economic and occupational employment patterns of some industrialised countries and assess the feasibility of forming occupational families with the help of traditional occupational nomenclatures.

2.1. Industry and occupational pattern

In order to assess future trends, we compare the industrial and occupational structures of some industrialised countries to find out common patterns or lead-lag relationships. A detailed international comparison of economic structures goes beyond the scope of the present study. Employment in industry is, therefore, only broken down into the primary sector (agriculture, mining and quarrying), the secondary sector (manufacturing) and the tertiary sector (services). Consequently, the occupations are also sub-divided into primary, secondary and tertiary occupations. The figures are presented in tables 1 and 2. The breakdown of industry into three sectors reveals, for the period 1950-1960-1970 and for the five countries considered, a continuous increase of the service sector and a decrease in the agricultural sector. This is in line with the three sector theory of Fourastié: technological progress in the primary and secondary sectors leads to an increased production of food products and consumer goods and brings about a gradual saturation. Increased satisfaction of the demand for primary goods and services is accompanied by a rising demand for services which gives rise to an overall shift in production towards the service sector. The shift in production entails a changing of jobs, but jobs in the service sector differ from those in the other two sectors. The workers made redundant have to be retrained or acquire further skills for jobs in the service sector.

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Table 1: Breakdown of industry into primary, secondary and tertiary sectors for some industrialised countries 1950-1960-1970

Table 2: Breakdown of occupations by primary, secondary and tertiary occupations for some industrialised countries 1950-1960-1970

Country / Economic sector	Federal Rep. of Germany			France			Japan			Sweden		USA		
	1950	1961	1970	1954	1962	1968	1950	1960	1970	1960	1970	1950	1960	1970
Primary	25,9	16,1	9,0	30,2	22,3	17,0	59,0	33,8	19,8	14,5	8,7	14,2	8,1	4,6
Secondary	39,3	44,8	46,9	33,8	36,5	37,7	20,9	28,5	34,1	42,5	39,8	32,5	34,4	31,7
Tertiary	34,8	39,1	44,1	36,0	41,2	45,3	29,1	37,7	46,1	43,0	51,5	53,3	57,5	63,7
Total (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Total	22,98	26,72	26,72	18,53	18,87	19,91	35,59	43,70	52,09	3,23	3,40	57,29	63,76	75,00

Country / Occupation sector	Federal Rep. of Germany			France			Japan			Sweden		United States		
	1950	1961	1970	1954	1962	1968	1950	1960	1970	1960	1970	1950	1960	1970
Occupations														
primary (agricultural occupations)	22,8	14,1	7,9	28,7	21,7	16,7	47,2	32,0	19,2	13,6	8,0	12,9	7,2	3,8
secondary (manufacturing occupations)	43,7	43,6	41,8	36,6	38,8	37,7	25,2	31,9	35,4	40,7	38,3	37,1	35,6	33,2
tertiary (service occupations)	33,5	41,9	40,3	34,7	40,0	45,6	27,6	36,1	45,4	45,7	53,7	50,0	57,2	63,0
Total (%)	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Calculated from: Beiträge zur Arbeitsmarkt- und Berufsforschung No. 9, 1976, tables 7 and 17.

Although the development of the primary and tertiary sector is consistent with the above-mentioned three-sector theory, the secondary sector differs somewhat from the expected pattern. One must keep in mind, however, that in France and the Federal Republic of Germany, the employment of foreign workers is inflating the secondary sector, and also that in countries with initially high employment in agriculture, the economic and occupational shift towards the service sector is accomplished by means of an expansion of the secondary sector. In other words, workers who leave agriculture do not move in general directly to service-oriented jobs, but take jobs in manufacturing whereas workers previously employed in manufacturing switch to the service sector.

Furthermore, traditional classifications may reflect the actual development in broad terms but do not depict reality. Occupational changes may occur within the occupational categories without being reflected by a change in the occupational titles. There is some evidence that this happens particularly in the secondary sector. An investigation into job patterns in the Federal Republic of Germany revealed very clearly that the official classifications overestimate the manufacturing part and underestimate the service part of a given job in manufacturing (1). Primary activities tend to decrease whereas administrative, distributive and dispositive activities become more important. Service activities are being incorporated more and more into manufacturing occupations. We can state that, for the United States and Sweden (often considered lead-countries in economic and occupational development), the trend towards a service society emerges quite clearly, with decreasing employment in the primary and secondary sectors. These findings must be taken into consideration when drawing up an occupational basic training.

2.2. Traditional occupational classifications and occupational families

The creation of occupational families for training purposes requires classification according to common job-content oriented characteristics (*). It is doubtful whether this can be achieved by the existing occupational classifications.

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(1) HENNINGES, H, CHABERNY, A, JELITTO, R: Neue Daten zum Wandel der beruflichen Aufgabenstruktur in der Bundesrepublik Deutschland, in: Mitteilungen aus der Arbeitsmarkt- und Berufsforschung 1977/1.

(*) Several countries have tried to regroup with the help of the traditional classifications into occupational and educational families:

- West Germany: eleven occupational families: administration and management; metal; electrical engineering; construction and wood; textiles and clothing; chemistry, physics and biology; printing and paper; painting and interior decorating; health and hygiene; nutrition and housekeeping; agriculture.

(*) Continuation of footnote:

- Denmark: eight occupational families: service trades, commerce and office trades; construction, iron and metal trades; graphical trades; food stuff trades; agriculture and horticulture; transport.
- USA: 15 occupational families: business and office; marketing and distribution; communications and media; construction; manufacturing; transportation; agri-business and natural resources; marine science; environmental control; public services; health; hospitality and recreation; personal services; fine arts and humanities; consumer and homemaking.
- Finland: 16 occupational families: electricity; construction; industrial sewing; office work; motor vehicles and transport; food; footwear and leather; rubber; heavy earth removing; metal; service industries; process industries; woodwork; peat industry; storage; upholstery.

We have compared the classification criteria for the occupational nomenclatures used in Belgium, the Federal Republic of Germany, France, Italy, Sweden, the United Kingdom and the United States, as well as that of the International Labour Office's International Standard Classification of Occupations (ISCO). The Swedish, Belgian and Italian taxonomies of occupation are based on the ISCO. Thus a further investigation of the classification principles for these may be ruled out.

The basic principle of occupational classification according to the type of work performed has been widely applied, as, for example, in the case of ISCO.

Nowadays, however, due to the varying aims pursued, other classification criteria are being selected and influence the classification process. The French taxonomy of occupations, for example, distinguishes sometimes according to skill levels (eg cadres, ouvriers spécialisés, ouvriers qualifiés), sometimes according to status). The German occupational nomenclature mixes manufactured product, occupational environment (eg traffic occupations) and occupational task (eg public order and security).

As a result, we can conclude that there is no unique occupational nomenclature to be used for all classification purposes, such as job exercised, occupation learned, training required or type of product produced. A separate classification with its own classification criteria has to be developed for each

purpose. This also holds true for our own purpose, a basic occupational training. In the next chapter, therefore, we shall develop some principles for the construction of educational and occupational families with a view to their applicability for training.

3. Principles for the formation of educational and occupational families

3.1. Theoretical framework

Economic and occupational change - as illustrated in tables 1 and 2 - is conditioned by a series of assumptions:

a. Occupational mobility is expressed by the movement c workers from one sector to another, particularly from the primary to the secondary sector, and from the secondary sector to the tertiary sector. These movements confront the worker with new occupational requirements. Often these requirements cannot be met without appropriate preparation during the initial training period or without further training during, or alongside employment. In extreme cases, occupational and sectoral change can lead to the emergence of new occupations, but all the evidence suggests that this rarely happens.

In this context, there is another concept linked with that of "occupational mobility":

. firstly, an occupation encompasses a broader range of skills than those acquired during the initial training period

. secondly, a limited number of training areas apparently suffice for the performance of most of the jobs available

A specific occupation can sometimes be exercised alternatively by people with various qualifications. This characteristic which refers to differing kinds of training (field of training, level of training) is termed occupational flexibility. Occupations can differ considerably in their flexibility. There are broad occupations with a high flexibility potential like retailing and narrow ones with low flexibility like medicine.

b. Occupational substitution occurs when employers have to fill jobs with workers who do not possess the specific job skills required. This happens, in particular, during periods of labour shortage and also in the expanding service sector. In other words, workers who have carried out occupations in the primary and secondary sectors have to be placed in tertiary jobs due to the unavailability of workers with tertiary qualifications.

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In this context, there is also another concept linked to occupational substitution:

. firstly, an occupational training encompasses a broader range of skills than those required at a specific workplace

. secondly, only a limited number of occupational positions can be filled solely be workers with a specific training. In most cases, training qualifies for several different occupations.

This characteristic is termed polyvalence of training. Training courses may differ considerably in their capacities for polyvalence.

The point is to enable individuals to be more flexible, to prepare them for and encourage life-long learning. They should be able to meet change and re-orientation not only by passively reacting to a varying working environment, but also by actively pursuing changes. (1).

The main goals of occupational basic training based on occupational and educational families in relation to flexibility are:

. an increase in occupational flexibility and an optimisation of flexibility processes;

. utlilisation of the objective flexibility possibilities to the fullest extent required;

. prevention of occupational downgrading;

. obtaining, maintaining and furthering the greatest possible congruence between manpower qualifications and elements of employment requirements;

. sufficient qualifications for occupational specialisation and adaptation to future change;

. securing employment;

. extending the willingness for, and ability to, carry out mobility and the correction of a wrong occupational and/or educational choice;

. aiding the so-called unmotivated and handicapped, when they are threatened by an interruption in their vocational training.

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(1) NUTHMANN (R), Eingrenzung von Tätigkeitsfeldern; Verstärkung des Praxisbezugs oder Erhöhung von Mobilität und Flexibilität? in: Hartung, D, Neef, W, Nuthmann, R, Tätigkeitsfeld und Praxisbezug, Stellungnahmen zur Eingrenzung von Tätigkeitsfeldern und zur Verstärkung des Praxisbezugs von Bildungsgängen im Hochschulbereich, Hamburg 1974 (pp 23 - 54).

We should take the existing labour substitution and mobility flows as a yardstick for the formation of occupational families for which a basic training should be conceived. The flows have to be analysed by type, level and direction. The concept of flexibility is derived from traditional research on qualification needs but far transcends it. It is not merely an analytical tool; its true function is to provide a more accurate definition of standards and objectives for educational programmes in general and for occupational basic training programmes in particular. Consequently, the results of empirical flexibility research may be used as a guide to educational policy and political action.

Such a project of creating educational and occupational families as a base for occupational basic training also requires stability, validity and reliability of the occupational families in the future. An occupational family oriented training necessitates a more abstract and theoretical approach than a highly specialised training. It also needs a certain period before becoming fully applicable.

This is compensated for however, by the fact that it gives better protection against obsolescence than a narrow, specialised occupational training.

Long-lasting validity, reliability and stability of occupational families is assured by self-regulating mechanisms of the education and employment system. The hypothesis is as follows: the set of skills which are connected to a specific occupational image often prevent the acceptance of these skills by the employment system, although the educational system produces them (1). Graduation from a specific training course means that the graduate develops his capacities and abilities in this field, but, at the same time, he has to accept a limitation of his future occupational opportunities whist having no guarantee of a certain remuneration or status. The qualification, allocation and status functions of education balance each other in relation to certain behavioural patterns of workers, and also employers when they are recruiting workers with specific training.

We can illustrate this by an example: training in business administration limits the number of occupational opportunities. If a graduate in business administration opts for a position as a sales representative in industry the allocation mechanism blocks a subsequent job change to for example that of a typist, although the training received would be sufficient. Status considerations rule out this particular change of job.

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(1) BECK, U, BOLTE, K M, BRATER, M: Qualitative Veränderungen der Berufsstruktur als Voraussetzung expansiver Bildungspolitik. Beitrag zum Forschungstreffen: wissenschaftliche und politische Aspekte der beruflichen Flexibilität in der bildungs-, Arbeitsmarkt-und Berufsforschung, Nürnberg 1977.

The mutually stabilising effects of qualification, allocation and status prevent mobility flows between all types of occupational positions, as well as substitutional flows between all fields of education. In other words: occupational mobility occurs in particularly frequented channels between some occupations; thus mobility or occupational families can be determined. A similar argument holds true for occupational substitution, with the difference that substitution occurs in channels between certain training fields. Thus, substitution or training families can be discerned.

In view of the fact that occupational and educational images do not change rapidly, we consider it justifiable to derive information on mobility, substitution, polyvalence and flexibility from past trends in the formation of occupational families in order to predict.

The following hypothesis has to be kept in mind:

. Mobility between different educational and occupational positions will be smoother, the more an individual is able to use knowledge, skills and experience in his new educational/ occupational position which he has already used in his original position and the better he is educationally prepared for the new position.

. The interchangeability (occupational substitution) of individuals with different qualifications will be the smoother the more similar the individuals' qualifications.

These assumptions imply:

The higher the degree of overlapping between two fields of training, the higher their mutual substitutability; the higher the degree of overlapping between two jobs, the more job changes are facilitated.

If we compare training profiles and occupation profiles, we find in many cases that they do not correspond satisfactorily. On the other hand, they need not match exactly since occupational profiles may evolve rapidly and no-one should be tied to a particular job forever. Discrepancies between training and occupational profiles can be minimised through the adaptation of the job profiles to the training profiles of the workers (= occupational substitution) and vice versa (= occupational mobility), eg by permanent education or a general basic training.

3.2 Approach

Some examples of occupational flexibility may serve to illustrate the concept:

a. Occupational mobility

. An individual moves from one occupation to another (ie a locksmith becomes a mechanic, or vice versa) (Inter occupational mobility).

. An individual changes his activity within a specific occupation on the same job (ie in 1950, a shoemaker spent 90% of his working time repairing shoes and 10% selling them; in 1970, he spent 90% of his working time selling shoes, repairing shoes only occasionally).

(Intra-occupational mobility)

. An individual changes from one job to another.

. An individual changes his status (ie a blue-collar worker changes to a white-collar worker or vice versa).

. An employed person becomes unemployed or vice versa.

We can differentiate between actual mobility (change accomplished), latent mobility (given willingness to change), and potential mobility (willingness and accomplishment possible under certain conditions).

Ad a. Concerning the analysis of occupational mobility processes:

. How many individuals with a specific (original) occupation (eg mechanic) have moved to a new occupation (eg locksmith)? How many individuals have left their original occupation?

Mobility rates related to the original occupation may then be determined. This type of mobility will be called mobility in the form of withdrawals (withdrawal mobility).

. How many individuals with the original occupation/educational degree X are recruited for the new occupation Y? From what occupations, and to what extent, will the (new) occupation be composed of?

. Mobility rates related to the new occupation may then be determined. This type of mobility will be called occupational mobility in the form of new entries (entry mobility).

b. Occupational substitution

Employers replace mechanics by locksmiths (foreign workers by nationals, university graduates by non-graduates, or vice versa).

Ad b. Concerning the analysis of occupational substitution processes:

. To what extent does an occupation/educational degree (eg locksmith) replace another occupation/educational degree (eg mechanic)? To what extent do other occupations/educational degrees replace a specific occupation/educational degree? The answers to these questions are based on information about so-called active substitution processes.

. To what extent has an occupation/educational degree been replaced by another occupation/educational degree? To what extent has an occupation/educational degree been replaced by other occupations/educational degrees? The answers to these questions are based on information about so-called passive substitution processes.

3.3 Formation of occupational and educational families

The determination of substitutional (= educational families) and mobility areas (= occupational families) requires the following information:

. absolute frequency (number) of education a, b, c ... n, (or occupations A, B, C ... N);

. absolute frequency of kind of education a, b, c ... n, replaced by the remaining other kind of education (or absolute frequency of occupations which can replace other ones);

. combinations of the above-mentioned frequency distributions into a substitution matrix (or a mobility matrix wherein A, B, C ... N would stand for a, b, c ... n):

Type of education / Replacing education	a	b	c	...	n	Σ (line sum)
a						100
b						100
c						100
.						.
.						.
.						.
n						100
Σ (column sum)	100	100	100	...	100	

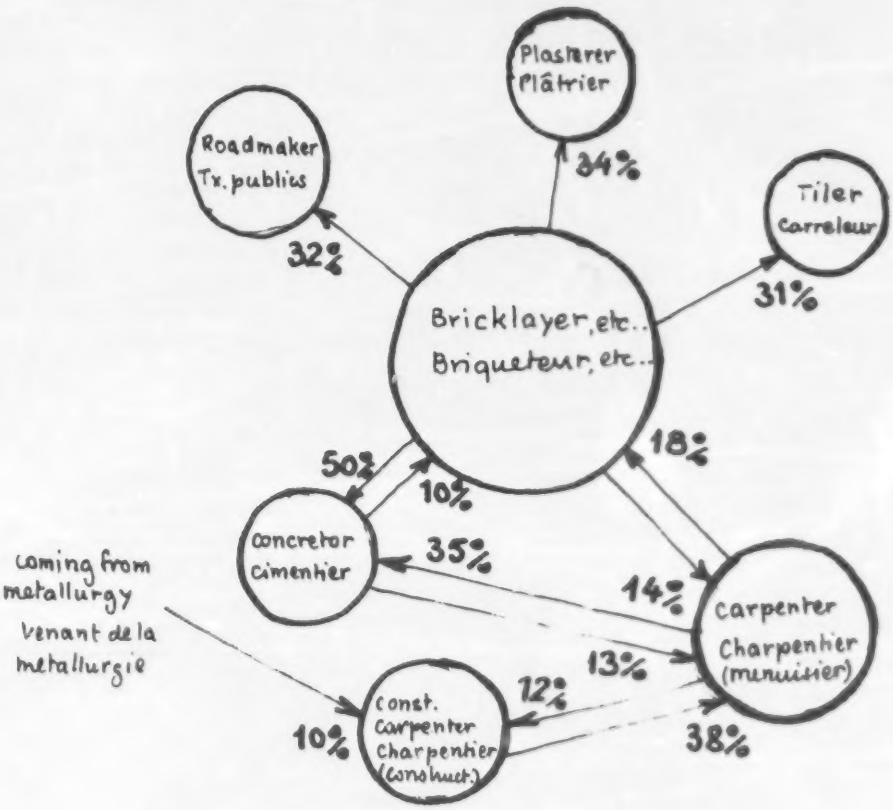
. relative frequencies have to be calculated by relating the absolute frequency to the column sum. Question: What percentage of education type a. can be replaced by type of education b, c, etc = passive substitution. (Or in the case of occupational families, what percentage of occupation A is replaced by occupation B = departure mobility).

. relative frequencies have to be calculated in relation to the line sum. Question: What percentage of education type a. replaces education type b, c, etc = active substitution. (Or in the case of occupational families, what percentage of individuals shifted to occupation A from occupation B = recruitment mobility).

. decision and determination of substitutional (mobility) relationships between types of education (occupations) in terms of a narrow or broad relationship.

In a representative sample - 0.5% of all male employees in the Federal Republic of Germany (1970) - supervisors of male employees were questioned about alternative training fields and levels required when filling a particular job. The diagram below gives an idea of the results. It has to be kept in mind that only substitution relations - in this case latent substitution - with at least 10 per cent are depicted. The varying circle size refers to the varying degrees of substitutional relationships.

Example: bricklayer and concretor. 10% of the work places for bricklayers can also be filled with concretors. Inversely, 50% of the work places for concretors could be filled with bricklayers.



Central and peripheral types of education can be discerned, whereby a central education is characterised by substitution relationships with more kinds of training, and a peripheral education by one or two substitution relationships with other types of training.

Taking a narrow substitution relationship as a yardstick, three areas of substitution can be clearly discerned:

1. training in construction activities incorporating the central training of a bricklayer;

2. training in commerce encompassing the two central types of training of a salesman as well as of an office clerk in industry (Industriekaufmann);

3. training in metal and electricity work including the central training of a mechanic.

From another representative sample (0.5% of all male employees in the Federal Republic of Germany 1970), information has been gained on withdrawal and entry mobility. The remarks made for the above diagram are valid with the exception that the figures refer to accomplished mobility.

Withdrawal mobility is illustrated by the cluster of occupations consisting of office clerks/office salesmen, sales representatives, commercial agents, wholesalers, retailers, and shop assistants.

12 per cent of the office clerks in industry became retailers and wholesalers and 17 per cent of the wholesalers and retailers became office clerks in industry.

Withdrawal occupations characterise an occupational family when individuals from these occupations change very often to other occupations (= entry occupations). Three occupational families can be determined:

1. The mobility cluster of "commercial occupations" in which the most attractive occupations are firstly, "office salesmen and office clerks" and, secondly, "wholesalers, retailers and shop assistants" ("entry cluster" of occupations).

2. The mobility cluster of "metal-working occupations" in which the most attractive occupations are "locksmiths and machinery fitters".

3. The mobility cluster of "transportation occupations" in which the most attractive occupation is "motor-vehicle driver".

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Entry mobility can easily be explained by the example already used for illustrating withdrawal mobility: 17% of the office clerks in industry have previously been employed as wholesalers and retailers. However, only 12% of the retailers and wholesalers had been employed as office clerks.

Entry occupations are characterised by the fact that individuals move from other occupations (withdrawal occupations) towards specific occupations. Four mobility areas can be distinguished:

1. The mobility cluster of "electricity occupations" in which the occupations "electrical fitter, building electrician etc" have the highest withdrawal potential.

2. The mobility cluster (also in the form of withdrawals) of "building" and "wood-working" occupations.

3. The mobility cluster of "commercial occupations" in which the most attractive occupations are firstly, "industrial economists and office clerks" and, secondly, "wholesalers, retailers and shop assistants" ("entry cluster" of occupations).

4. The mobility cluster of "metal-working occupations" in which the most attractive occupations are "locksmith and machinery fitters".

It should be added that, when determining training and occupational families, other methods may also be applied as well, for example, splitting the various types of training and occupations into their component parts and evaluating degrees of overlapping.

4. Implications

The implications concerning occupational basic training are twofold: firstly they stem directly from the previous analysis of occupational and educational families and, secondly, they arise from considerations concerning the structuring of the training system.

4.1. Implications arising from the analysis of educational (occupational) families

a. Training should be shaped towards service occupations.

Those types of training which qualify for primary (agricultural) and secondary (manufacturing) jobs should be enriched with tertiary training elements. This can be deduced from the fact that tertiary (service) components in primary and secondary occupations are increasing and that service occupations in general will gain importance in the future. The training modules should be kept rather general.

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b. Comparison between the number of occupational families and the number of mobility and substitution areas.

In case of doubt, the number of occupational families derived from empirical mobility data should be lowered. It should be assessed, for example, whether the field "printing and paper" is already incorporated in "metal and electrical engineering" or "painting and interior decorating" in "building and wood-work". On the other hand, the creation of new occupational families should not be ruled out. The example of "transport and repair occupation" could be taken as an illustration, as this occupational family is insufficiently reflected in the educational system.

c. Marginal occupational families

There exists a series of smaller occupation and education families like baker and confectioner or occupations like hairdresser, tailor, butcher which do not form part of a substitution or mobility area. In view of a polyvalent training, we have to reflect where they can be fitted in.

d. Central-type training and occupation

A major part of central-type training includes elements which enable flows amongst themselves and to/from peripheral types of training. As a consequence, training should qualify for those occupations which facilitate a subsequent job change.

e. Variability of occupational families

The lower the number of occupational families, the less the risk of changing occupational families in the future. As has already been mentioned, economic and occupational change develops more in structural-quantitative terms and less in qualitative terms (eg emergence of new occupations or types of training). If, due to new production methods, new occupational activities, for example, are generated, they in general develop out of an existing occupational or educational area. In the medium and long run, it cannot be ruled out that a shift between central-type training/occupation and peripheral training/occupation will occur or that new occupations will be created. An occupational basic training has to aim at setting the worker in a position to cope with these changes. Concepts such as life-long learning, permanent education or recurrent education come to mind. This leads us to the following chapter on implications for the training system.

4.2 Implications arising from considerations for training

a. Qualifications towards occupational areas.

Occupational-field oriented skills are located between purely

data training and key qualifications (1, 2). The latter do not directly relate to a specific job or job field but comprise a set of skills at a higher level of abstraction which are necessary for the performance of jobs, such as power of analytical analysis, judgement, creativity etc. On their own, however, they are not sufficient.

The subsequent transformation of occupation-field-oriented skills towards specific occupational activities is more promising than the transformation of general key qualifications into occupational job characteristics. Training for occupational areas also leads to the acquisition of some general key qualifications. All these considerations suggest that training in key qualifications should be performed along occupational lines and with the help of job-oriented characteristics. The following skills can be considered to be occupation-field oriented:

- knowledge about specifications and composition of goods, materials and data,
- knowledge of the basic techniques for the manufacturing and the transformation of goods and the usefulness of these data,
- general knowledge about areas and conditions of applications of the products produced, based on these materials and/or data sources,
- knowledge about job safety,
- ability to communicate and co-operate in a team working within a given occupational field,
- knowledge and proper handling of documents which are characteristic of specific occupational areas.

b. Change of (vocational) curricula and the educational system

The various fields of training have to be related to occupational/educational families and basic education courses, vocational courses and a unit/credit system must be set up (3). Basic training following these lines not only increases the

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(1) MERTENS, D: Key qualifications in basic and further education, CCC/EES (72) 10.

(2) MERTENS, D: Survey of research on occupational flexibility, CCC/EES (72) 134.

(3) Council of Europe: Objectives in vocational unit/credit systems, CCC/EGT (76) 32. Council of Europe, Strasbourg 1976.

mobility potential but also delays the final occupational and educational decisions (ie occupational specialisation) until a more mature age is reached and the individual can take a sounder decision. A favourable side-effect would be that a well-based occupational choice motivates towards completion of a training course.

New skills are required as a consequence of occupational and economic change. From a cost-benefit point of view, occupation-field oriented training should be favoured in comparison to specialised occupational training because, in the first case, at least part of the training attained does not become obsolete. The training system as a whole need not be changed. Part of the training courses could serve as a base for the teaching of the newly required skills.

c. Career guidance

Polyvalent and flexible forms of training provide better safeguards for the future than those types of training with a limited application. Educational and career guidance following occupation-field oriented lines could be made more reliable and avoid frictions between the educational and the employment system.

d. Conditions for mobility and substitution

The achievement of the desired mobility and substitution movements requires the provision of conditions for the appearance of these flows. Practical opportunities for the movement of workers and for the substitution of training have to be elaborated and made public if the desired flexibility is to be achieved. Part of the frequent mobility and substitutional movements are already incorporated into the occupational training approach which is based on occupational families. Thus, future change is anticipated and facilitates occupational changes.

e. Training of educators

It is obvious that a change of curricula according to occupational fields requires qualified educators. Educators who, themselves, have to be trained in a highly flexible way because, firstly, they have to teach polyvalent qualifications and, secondly, they have to be able to teach other or even new vocational subjects if the need arises.

f. Some favourable side-effects

There are some favourable side-effects associated with training along occupational lines as outlined above. For the purpose of educational planning, supply and demand can be better projected for occupational families than for occupations which are interrelated. The higher the substitution (or mobility) interrelationship within the education (or occupational) category and the lower the interrelationship between the categories, the more accurate

the forecast. With the free movement of labour amongst the countries of the European Communities, training along educational (occupational) family lines in all member countries would abolish some of the barriers to migration between countries. Of course, congruent occupational families may not always exist. Occupational and educational families, like the traditional industry and vocational patterns, reflect particularities which are specific to each country. However, educational and occupational families will definitely vary to a lesser extent from country to country than the traditional classifications. A European community aiming at further labour market integration will have to harmonise training standards in common occupational fields, thus making migratory movements easier (1).

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(1) Council of Europe: How, and to what extent, technical and vocational education can encourage occupational mobility? CCC/EGT (75) 23, Council of Europe, Strasbourg 1975.